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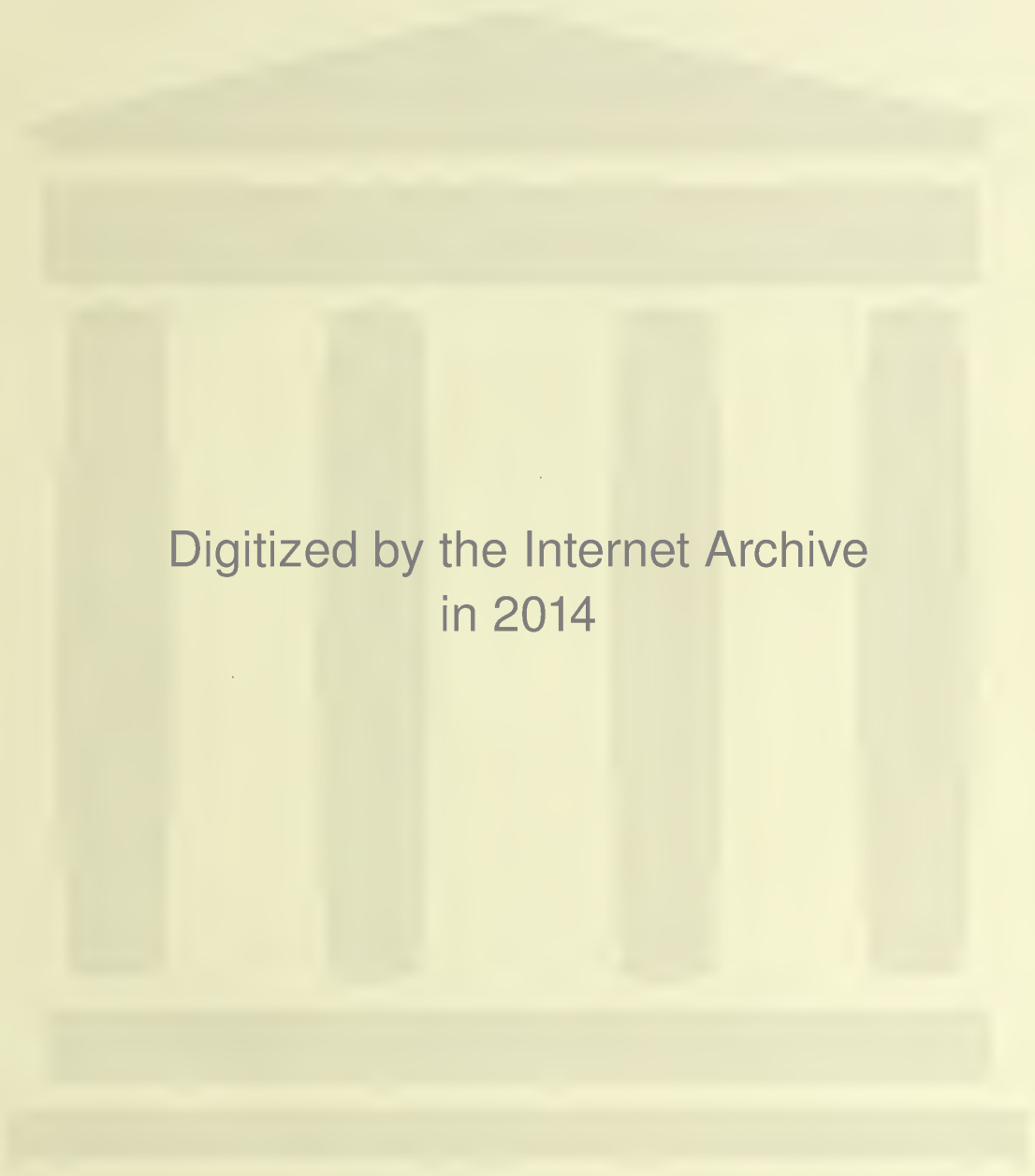

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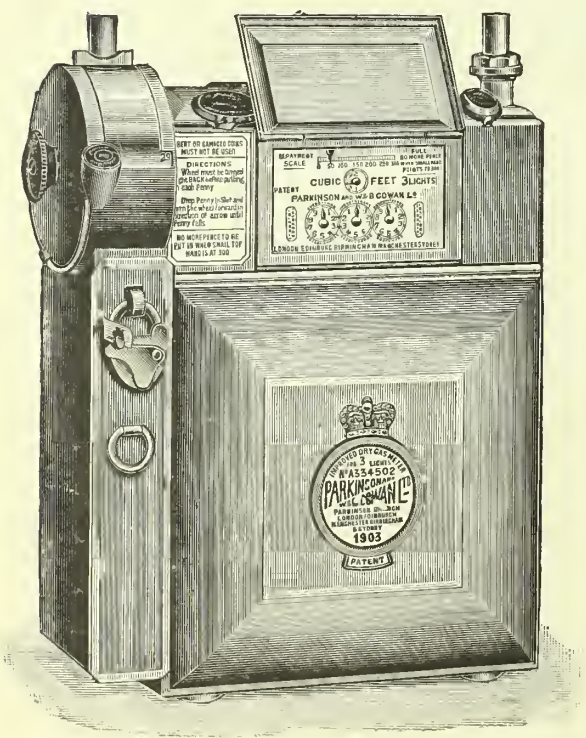

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EDITORIAL NOTES—GAS, &c.

Carbonization—A Large Inquiry.

THE merest glance at the last few issues of the "JOURNAL" will convince the members of the Committee appointed by the Council of the Institution of Gas Engineers to consider the question of carbonization, that the reference to them, while it will be interesting and instructive, is at the present time by no means an enviable one. The questions and problems involved are in a chaotic and transitory state, are all far-reaching in character, while the amount of really definite data and experience, other than that associated with established systems, is somewhat scarce. Recent work on carbonization in vertical retorts and in chambers dealing with larger charges than ordinary retorts, has done much to upset traditional views; or, as Dr. Bunte lately put it, our ideas, in consequence of that work, of the phenomena of the destructive distillation of coal have been considerably broadened. No one until that work commenced had any very pronounced belief that it was possible to obtain a greater make per ton of coal (of a quality of gas suitable for modern application) than was being realized by the best of the processes of the time. But, as Mr. Charles Hunt remarked in his recent Presidential Address to the Institution of Gas Engineers—almost echoing the synchronous words of Dr. Bunte—the experience of to-day indicates the existence of a further reserve to be drawn upon for the production of low-grade gas by the application of suitable methods of manufacture.

It is not for us to suggest the lines of research to the Sub-Committee appointed by the Institution. But to-day it is impossible for such an inquiry as they have undertaken to stop at what were until recently the orthodox carbonization practices in the gas industry; and therefore the broad reference to them must involve an inquiry that will occupy considerable time, if their work is to be really comprehensive and thorough. That it can possibly be even reasonably final for a long time to come, no one will dare to submit at the present day without being written down as one who is incapable of seeing beyond his nose. Both the horizontal and the inclined systems of working are not what they were; but, even so, vertical retorts and carbonization in bulk have come, and are boldly challenging the older systems for supremacy of result, when all points from labour to product in gas and residuals are taken into the reckoning. The vertical retort, it is claimed by those who are enrolling themselves as its adherents, offers the merits of more natural construction and operation, and promises to afford, as compared with working predecessors, a larger yield of gas and ammonia, better coke and tar, and gas freer from naphthalene. While for carbonizing in bulk in chambers of greater dimensions than the largest known sizes of ordinary retorts—not passing in one jump from the comparatively small-charge method of to-day to the practice of the bye-product coke-oven adapted to the needs of the gas manufacturer, but stopping at some "half-way house" with horizontal, inclined, or vertical chambers—the claim is not that the production results will rank much, if any, higher in excellence than they are in present systems, but that there will be a saving in labour, and an improved coke. Modern mechanical methods in the retort-house have left very little waste ground for such systems to reclaim if that is the full scope of the advantage to be derived by the use of these larger chambers. But such chambers have not as yet had the opportunity vouchsafed to them that has been accorded to vertical retorts, which are making considerable progress on the Continent, despite the doubts that exist in many minds as to their ultimate deportment in operation.

With regard to the large chamber working, it will be remembered that the late Herr Merz, of Cassel, tried a setting that was intermediate between a chamber oven and a retort; and it was only a few months ago that Herr Eisele was telling us the setting was still in operation. The yield of gas, however, per ton of coal used and per square foot of ground-space, was smaller than with ordinary retorts; but the coke obtained was better, harder, and denser. Again, at the Munich Gas-Works, large inclined chambers have been under trial for some twelve months. They measure 13·1 feet by 5·9 feet by 1·64 feet. In a recent continuous run of ten days, the average production of gas—Herr Ries, the Manager, informs his professional colleagues—was 10,733 cubic feet, of only 10·8-candle power, but of 662 B.Th.U. gross (596 B.Th.U. net). The coke was of good size with little breeze. Data as to this and the other residuals are available in our columns (June 18, p. 810). The chief advantage claimed at Munich is economy of labour, as compared with any system of continuous carbonization; the economy arising from the chamber being charged only once in 24 hours. The coal used in this working was of German origin; and, of course, much in the way of result depends on the characteristics of the coal carbonized and the temperatures employed. But, on the face of it, the working is not superior to what is customary, and certainly does not give such promise as the vertical system. Clearly, we have not yet got to the end of the trials with these chambers; and we look for knowledge being supplemented by them.

There has now been a mass of particulars published regarding vertical retorts; but the working statistics and the general information are not so comprehensive as are requisite for framing anything like a final verdict, or for any decided favourable view as to supremacy in result as between continuous working and intermittent charging and discharging—other than that with the former there is complete freedom in the retort-house from the disagreeable accompaniments of intermittent operation. Continuous operation, too, is, jointly with high result, the goal of all fresh workers in this field. But as to product results, there is not yet much to choose between the two—continuous and intermittent systems of working. In the first editorial in the "JOURNAL" on June 18, reference was made to Herr E. Körting's working at the Oberspree station in Berlin; and it will be seen that (with his 5-metre retorts, and working intermittently, he is getting much the same gas results per ton of coal carbonized, with much the same calorific power, as Messrs. Woodall and Duckham are doing at Bournemouth, where they are running continuously ("JOURNAL," June 4). But the question of the quality of coal vitiates comparison. This is seen also with regard to the production of gas per retort per day. Some few months back, we had Dr. Bueb reporting a yield of from 10,600 to 14,100 cubic feet per day per 4-metre length of retort; while Herr Körting puts his average with 5-metre retorts at 14,800 cubic feet, which (if Dessau was using the same coal when getting their maximum yield per retort) would not be such good working as Dessau's maximum per metre of retort, though per ton Oberspree and Bournemouth (with their averages of 13,000 cubic feet) come out far superior to Dessau, with its make of from 10,765 to 11,840 cubic feet per ton. But there are for comparative purposes so many disturbing factors in all these published figures, that they must, to be of real value, be amplified with information, and reduced to something like order, by those who alone can give the particulars from their inner knowledge. Again, we get the calorific power of the gas at Oberspree stated at 550 B.Th.U.; at Bournemouth, as 546 B.Th.U.; at Cologne (where there is now the largest vertical retort system in existence), as 500 to 562 B.Th.U.; and at Dessau as 573 to 607 B.Th.U. We take it these are all gross values; but it would be of advantage if "gross" or "net" was always mentioned, in order to avoid misconception and misstatement. However, the figures are interesting in their closeness between Oberspree and Bournemouth and in the wide variations exhibited by Cologne and Dessau (with the same length of retort), and by the inclined chamber working at Munich, as previously mentioned.

Inquiry into this question of carbonization, too, cannot be

complete, without taking into account the examination made of the principles affecting modern working by the late Mr. W. Young, by Mr. W. R. Herring, Mr. Thomas Glover, Herr Körting, Dr. Bueb, and others. It will be found that the problems facing the Institution Committee comprehend physical, chemical, practical, financial (capital, maintenance, and working expenditure), and commercial considerations. The task is big; the ground upon which to work rough and, as has been indicated, bestrewn with difficulty; and the result (owing to unstable and transitory experimental conditions), for some time to come, may not give full satisfaction. But it may give interim direction. If that be so, it will be something gained.

Electrolysis—A Success in the House of Commons.

The Electrolysis Commission of the German Association of Gas and Water Engineers have now been prosecuting their inquiries since 1897; and their latter reports are significant of a deeper conviction than was evident in the earlier ones as to the tortious action of stray currents from electrical systems upon gas and water pipes. In the early days of their inquiry, it did not appear that any great harm was being done by wandering electric currents; then it was found that experiences differed somewhat between towns; and in time evidence was discovered of the insidious nature of electrolytic action, in its slow but sure deteriorating influence upon the substance and strength of pipes. The report which we publish to-day contains further testimony, and points to a serious condition of things, which has a close relationship with the question of public safety. The observations delineated in the report disclose phenomena which will not fail to be attractive to students of this subject and to owners of subterranean pipes. For instance, the Commission were informed three years ago that at Solingen nothing was known of the corrosion of gas and water pipes; eighteen months ago some of the tramlines had to be renewed, and destruction of mains in the subsoil became evident; now it is found that the stray currents have done harm over a large district—even to a distance of 2½ miles. That is the development of the story of destruction at Solingen. At Cassel, a peculiar condition of things was also observed. There an extensive tram service exists; and though the Managers at the gas-works were not aware of any destruction of their pipes, it was found that several mains crossing the rails in the immediate neighbourhood of one of the taking-off points were corroded. One main in particular was very severely injured; being completely eaten away in a certain spot to such an extent that gas escaped violently from it directly the clay soil round it was loosened. This is a fortunately discovered injury, that might have been the seat of untold mischief in Cassel. But what about injury of this kind that is not discovered, and may not be until there is some fell happening? The Cassel and Solingen experiences are proof that the fact of electrolytic damage not having come to light is no guarantee that it does not exist. Again at Karlsruhe, the state of the gas and water mains has become intolerable; and at Strasburg the Commission have gleaned some interesting information as to injury.

The merciless and esoteric workings of these stray currents which the careful labour of the Electrolysis Commission of the German Association has disclosed, have aroused the interest—and very properly—of the local authorities in Germany; and they have evinced a lively and helping interest in the investigations, and have, in fact, invited inspection and advice. Moreover, the electrical and tram associations fully realize the gravity of the matter; and instead of, as in this country, doing all possible to burke investigation, there has been a joining of forces to prosecute research. A Joint Commission has now been instituted to carry forward the work so far well and voluntarily done, and unassisted, by the Gas and Water Association—the constitution of the Joint Commission being four members of the Gas and Water Association, two members of the Association of Industrial Electricians, and two members of the Association of Tram and Light Railway Proprietors. Would such a coalition be possible in this country, where every inch of the way towards protection against injury to underground pipes devoted to the public service has to be fought for?

The Metropolitan Water Board have been one of the persistent fighters in this matter; and they have lately scored a victory in connection with the North Metropolitan Electric Supply Company's Bill, before Sir J. Leese's Committee in the House of Commons. The clause that has been inserted provides (to put it very briefly) that, if it be proved that any injury or damage is occasioned to the pipes, or other underground structures of the Board, by fusion or electric current generated or used by the Company, then nothing in the Act is to relieve the latter from liability to make compensation for any such injury or damage that would have existed but for the passing of the Act. In the discussion before the Committee, the Water Board were greatly assisted by Mr. C. H. Wordingham; and there were several points in his evidence well worth storing in memory. He controverted the statement put forward on behalf of the promoters, that it is impossible for alternating currents to produce electrolysis. He indicated sub-stations as likely places of leakage; and in the event of there being such leakages, he asserted that they would concentrate themselves near the generating-stations, and so might do considerable damage to the pipes in those localities. It was also submitted by Mr. Wordingham that "safety devices are of the most unreliable things in electrical "apparatus. One cannot be sure that they will always act. "They are intentionally made to allow a certain interval of "time to elapse, and a hole might be burnt in cast-iron pipe "in a quarter of a minute or less." The truth about such things is fearfully unpalatable to some British electricians. One of the features of the proceedings, too, was the production of a section of telephone pipe which had been pierced by electrolytic action since the electrification of the tramways in South London. The evidence submitted convinced the Committee that the Company ought not, through the omission of a protecting clause, to be relieved, in the event of injury, from the liability to make compensation which exists under the common law. How can the presence of such a clause in the Bill be a source of any injury or anxiety to the Company, when they submit that the Board of Trade regulations produce the perfect electricity distribution system? Why, it must be a waste of time, money, and energy to contest the matter under such circumstances.

The Commons, the People, and Municipalization.

Things are as they were in connection with the question of the electricity supply of London. The sacred "municipal "principle" has again scored in Parliament; and it is fitting to ask whether the House of Commons now represents the people or purely political dogma. The people of London in November and March last expressed, with unmistakable voice, their desire that the rash schemes of trading entered upon, and proposed to be entered upon, by the then Progressive-Socialist majorities in the local government of the Metropolis should forthwith cease, and to ensure this a fairly clean sweep was made of the gentry of the combination whose rule had been so subversive of the best interests of London. Following the decided mandate of the constituencies, the reformed London County Council altered that product of unbalanced intelligence—their Electricity Bill—which proposed to involve the ratepayers in a multi-millioned and speculative scheme of supply, in such manner that the risks would have been transferred from the ratepayers to private enterprise, while a large measure of control would have been vested in the Council, together with an optional reversion of the powers after a period. This action placed the majority of the House of Commons, which majority are for the greater part disciples of municipalization, in a quandary. Here they had on the one hand the mandate of the people of London, and on the other that sacred principle which, whatever befell, they had pledged themselves to uphold. That the Bill as transformed by the Moderates was more acceptable than the vainly extravagant original was manifested by the rapid secessions from active hostility on the part of Metropolitan interests. The Bill was referred to a Hybrid Committee; and without hearing the opposition, that Committee have declared the preamble of the amended Bill—it is said to be almost unanimously—not proved. In the interests of a mere political tenet, the well-instructed majority of the Committee preferred to ignore the voice of the electors of London rather than brave party ignominy by letting the Bill go forward; and all the time and money spent in parliamentary inquiry into this subject in the last few years have been so much time and money wasted.

The Radical Press are loud in their acclamation of the Committee. The decision was, of course, "expected" by them; for such a "flagrant betrayal of the municipal in-"terests"—mark you "municipal interests," not "public "interests"—could not be tolerated. It was not long since that, in the view of these same Radical papers, London industries were actually gasping—we failed to trace even the

symptoms—for electricity for power purposes; but they now accept it as preferable that London should continue to gasp until there is available the municipal brand of electricity, produced at the risk of the ratepayers, and callously acknowledged by the Progressives to, with certainty (if a scheme is passed by Parliament), commit the ratepayers to direct financial burden during at any rate early years. But as to this, the reasoning of fanatics is ever incoherent; and the reasoning is dictated by the circumstances of the time. The "Daily News," on the decision of the Committee, inflates itself prodigiously, and loftily avows that "no consideration must "lead us to consent to placing the Metropolis under the heel "of another crushing monopoly." A "crushing monopoly!" A "monopoly," if such it could be called, of this character, under parliamentary control, would be quite impotent in any attempted crushing manœuvres; and the factor of competition and the option of the people to patronize or otherwise, would also prevent such private enterprise developing into any such ugly monster as these excited municipalistic monopolists conjure up in their distracted imaginations. Private enterprise under control cannot be so oppressive as municipal government with power to tax ratepayers innocent of all participation in the muddling and mismanagement of those whose enthusiasm—carried to the point of febrile speculation—for a cause is out of all proportion to their ability to direct that cause on practical lines to proper issues.

"But what is to be done next?" ask our friends of the "Daily Chronicle," whose petulance in regard to the doings of the Moderates of the County Council has not been a tittle less than that of the "Daily News." We find their answer in the earnest trust that "by next session wiser and "more public-spirited counsels will prevail in the London "County Council, and that a municipal supply Bill, on "sound lines will be introduced." Between their aspiration and the realization stands a compact body of ratepayers who are not minded to be involved in large responsibilities to provide for manufacturers that which there is no proof the manufacturers will take in profitable quantity, even after it has been furnished. The County Council cannot without consulting the ratepayers—they are in honour bound not to do so—embark upon any scheme such as will meet with the views of the present Government. What is more likely is (if the life of the present Parliament is sufficiently prolonged) that the Government will relieve the County Council from further action by promoting a Public Bill for the creation of a Metropolitan Electricity Supply Board on the lines of the Water Board, and so force upon London what the ratepayers do not require. If this surmise is correct, then the decision of the Hybrid Committee last week was only a move in the game by which the parliamentary coalition have succeeded in holding the people of London in check while they pave the way to a further monument to communistic ideals and waste. But perhaps, if the supposition here expressed has real existence, before the Commons can do anything, the present dominant party will have again been placed in a minority. There is complaint by the existing majority of the actions of the House of Lords; the people of London have a right to complain of the action of the majority of the House of Commons. If the voice of the people is so much revered by the House of Commons, then there ought to be no forced imposition of an electricity scheme upon the ratepayers of London.

Where Ignorance is Bliss.

"Meteor" of the "Electrical Times" presents his readers with some loose remarks on the address of Mr. Charles Hunt to the Institution of Gas Engineers. The electrical people do not like comparisons of the cost per mile between incandescent gas lighting and electricity for street purposes. They regard it as a "ridiculous comparison," and a very inconvenient one. It is submitted by "Meteor" that Mr. Hunt, as President of the Institution of Gas Engineers and a member of the Institution of Civil Engineers, "is not entitled to plead obsolete or superficial knowledge when making a ridiculous comparison." Mr. Hunt is not likely to so plead, nor to admit that his comparison has any other than a sane and practical character. It is the old tale. "Meteor" is following the footsteps of all electricians in taking refuge behind the infinitesimal, which refuses to hide the abnormal character of public lighting accounts since electric lamps have been put up in a few central streets of towns. He says Mr. Hunt probably knows that arc lighting at Hastings does not, "candle power for candle power, cost anything like ten times as much as incandescent gas." Mr. Hunt was not talking of "candle power for candle power," but of the waste of ratepayers' money involved, in this case, in spending ten times more per mile on lighting by the electric system, while improvement can always be effected at smaller outlay by the incandescent gas system. We venture to assert that no town has received compensatory benefit for the large additional expenditure per mile on electric lighting. "Meteor" also asks whether Mr. Hunt seriously suggests that the promenades and show streets in health resorts should be lighted by gas? To save "Meteor" a shock, if Mr. Hunt troubles to reply to him, we warn him that that reply may be summed up in the single word "Certainly." We cannot think that "Meteor" has been to the Dublin Exhibition; if he had, he could not have honestly written: "The Dublin Exhibition has disgusted thousands of people with its tawdry array of gas mantles." "Meteor," too, presumes that Mr. Hunt's reference to "the idea of cheap fuel gas" taking "firm hold of the public mind," means that the public mind has absolved gas from all further responsibility in the provision of a perfect illuminant. If our journalistic contemporary will give a little thought to the bunsen burner, the calorific power of gas, and the needlessness of illuminating power when gas is used in the bunsen burner, the idea may take a firm hold of his mind that, when the gas industry is further released from grandmotherly legislation, a "cheap fuel gas" will be found to do all that is required for the gas industry to maintain and further its position as an economical illuminating agent. There is behind Mr. Hunt's words a reserve for progress by the gas industry in the provision of economy for the public.

The London County Council and Public Lighting Costs.

The London County Council are following in the wake of the Local Government Board, and are inquiring of the Battersea Borough Council whether they "have considered the relative cost of lighting the streets with gas and electricity?" This pertinent inquiry the Local Government Board have for some time past been putting to local authorities; and though the local authorities do not publish their answers, the pointed question is undoubtedly having a salutary effect, and is saving the ratepayers a considerable additional amount of useless expenditure. The question to the Battersea Borough Council was provoked by a most intemperate scheme that they have been counteuancing for lighting by electricity the roads on the Park Town Estate, and for which they made application to the County Council for sanction to borrow £2270. Having regard to the "heavy cost of installing electric light," and to the fact that little if any use would be made of the mains for private supplies, the Finauce Committee of the County Council have informed the Borough Council that they do not view the application for the loan with favour. We will give the old County Council their due by saying that they, too, were favourable to gas for public lighting, as the bridges across the Thames bear witness.

Some More Corporation Results.

In the present number of the "JOURNAL" there will be found notices of the annual reports as to the working of several more of the municipally owned gas undertakings; and these, like the earlier ones, are of a generally satisfactory character. The first mention may be given to the Edinburgh accouuts—which, however, are dealt with fully by our "Scotch Correspondent" this week. Here, it will be seen, the total revenue, at £325,222, is £17,647 more than that of the preceding year; while the expenditure has increased by only £6875. The quantity of gas sold—roughly 1931 million cubic feet—was about 86 million cubic feet above the figure for the preceding twelve months. The gross profit at Oldham is somewhat less than was the case the previous year; but this is merely due to a reduction in the charge made to consumers. In fact, during the past twelve months the average price realized for gas sold (including gratuitous lights—*i.e.*, the street-lamps and municipal buildings), fell for the first time below 2s.—the exact figure being 23·67d. The increase in the quantity of gas manufactured was just over 7 per cent.; while the loss by leakage (5·69 per cent.) showed a slight reduction. The amount by which the borough fund will benefit is £8515. From the profits at Nottingham, a sum of £27,000 is to be handed

over in relief of the rates; and this will leave a balance of £23,303 to be disposed of on depreciation, repairs of works and plant, &c. There was a slight increase in the gas sold. At Smethwick, £2000 is to be allocated in relief of the geueral district rate, and £1000 is to be contributed to the cost of the new Council House. In addition to this, £5961 is to be carried to the depreciation and suspense fund account. The output shows an increase of 5·65 per cent., which is the more satisfactory as it follows upon an increase of nearly 13 per cent. in the preceding year. The total income is £2508 more than last year, in spite of the fact that a reduction in price to small consumers absorbed over £500. The results at Coventry have been such as to permit the Committee to recommend that a sum of £2000 should be paid over to the district fund. This will leave a balance of £1492 to be carried forward. Sales of gas at Skipton show an increase of 7 per cent.; while the loss from leakage has been reduced to 3·2 per cent. The profit is slightly less; but here, again, the consumers have benefited by a reduction in the price of gas. The outstanding feature at Stafford is the unaccounted-for gas, which is only 2·06 per cent. of that sent out.

Workmen's Compensation Insurance.

The question of the new Workmen's Compensatiou Act was brought before the annual conference of the Institute of Municipal Treasurers and Accountants by Mr. T. Sumner, the Borough Treasurer of Birkenhead, who said that trouble from it was only what might be expected. He drew attention to the circular recently issued to local authorities by the Local Government Board (as noticed in the "Journal" at the time), which stated that it appeared to the Board that these bodies generally would be employers within the meaning of the Act, and that to the extent to which, in this capacity, they would become subject to liability which might be met by insurance, they might properly incur reasonable expenditure in effecting an insurance against their liability under the Act. This led the author to the real subject of his paper, which was the question of the best mode of meeting the liability. The prices quoted by various Insurance Companies made it evident to him that a gigantic "ring" had been formed, which did away with competition for business which was of a very remunerative character owing to the excessive rates that had been fixed. Mr. Sumner said that, so far as he was aware, there was no legal reason why a local authority should not protect themselves in regard to their liability by paying into a reserve fund a sum equivalent to the amount that would be paid to an outside company for covering the risk; or, as an alternative, they might accept the responsibility of being their own insurers up to a given figure—say, £700 or £1000—in any one year, and then take a cover from an outside company for the excess, in which case the premium would be materially reduced—to perhaps 2s. 6d. per cent. all round. Members who took part in the subsequent discussion approved of the idea of local authorities undertaking their own risks. At Birmingham, it seems, a determination has been arrived at to take the liability themselves for a year at any rate. Among other Corporations who have decided to run their own risks in the matter were mentioned Bristol and Nottingham. One gentleman, however, said that he found the Insurance Companies were treating Corporations upon their merits, for the simple reason that the risk in every case was not the same. No doubt in the course of a year or so employers of all kinds will be able to see a little more clearly than they do now to what extent the new Act will penalize them; but for the present there must be a considerable amount of uncertainty.

Mr. W. Thomson, the newly-appointed Manager of the Ramsgate Gas and Water Works, was presented with a handsome walking-stick, with a silver mount suitably engraved, as a parting gift from employees at the Kendal Gas and Water Works.

The recent death is announced of Herr Ludwig von Stephani, the founder and for many years the Manager of the General Austro-Hungarian Gas Company at Buda-Pesth. He was born at Mannheim, and was for 51 years at the head of the large undertaking in Buda-Pesth.

At the close of the report in last Tuesday's "Journal" of the remarks made on the resolution in regard to the International Photometric Committee submitted at the meeting of the Institution of Gas Engineers, it was stated that the resolution, as amended by the substitution of the words "up to and including 20 candles" for "under 20 candles," was carried unanimously. It has since been pointed out that there was one dissentient—Mr. Walter Grafton.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 57.)

The change—long hoped for, long deferred—has come at last over the wretched state of things on the Stock Exchange. It wanted only a spark to light up the gloom, in the shape of a word from the right quarter; and last week it came. It is remarkable that the depression could have been so heavy and so persistent, while general conditions pointed in the other direction. Misgivings and apprehension, though vague, were potent, and that shy bird, confidence, was badly scared. Now the Chancellor has spoken out and allayed the uneasiness; but it is a pity he did not do so earlier. The week opened in a way prepared for better things. Affairs abroad seemed less alarming, and a generally more cheerful tone was evident. When later on it was known that the Transvaal Loan was postponed, and that there would be no new home issues, a quick recovery set in. Consols rose $\frac{3}{4}$; and other departments moved sympathetically, though business was not booming. And so onward from day to day the tone continued to improve and prices rose, though checked now and then by the inevitable realization to secure profits. Consols (which had been done at $83\frac{1}{8}$ a few days previously) touched $84\frac{11}{16}$. In the Money Market, there was a very strong demand (it being account week, and the close of the half year), and a large business was done at higher rates. But discount rates pointed to increased ease in the immediate future, and steadily declined. Business in the Gas Market showed a falling off in volume, especially the earlier portion of the week. Changes in quotation were largely due only to *ex div.* adjustments. Actual variations were not numerous, and they were irregular—gains and losses being about on a balance. In Gaslight and Coke issues, the ordinary was in good favour, and added to its increase of the week before. On Tuesday, $92\frac{1}{2}$ was the figure. Thenceforward the price rose steadily, however, and 94 was repeatedly marked. The secured issues were very inactive. Nothing was done in the maximum or the preference; but the former gained a point. The debenture changed hands at from $82\frac{3}{4}$ to $83\frac{1}{2}$. There were an unusual number of transactions in South Metropolitan. On Monday, it was done at $119\frac{1}{2}$ (a fall of 1 in the quotation), and fell another point on Thursday, with business done at 117, but recovered 1 later on and touched 119. The debenture marked from $83\frac{1}{4}$ to $83\frac{3}{4}$. Commercials were very quiet. The 4 per cent. was done at $107\frac{1}{4}$ and $106\frac{1}{2}$. Among the Suburban and Provincial Companies, Alliance old marked 20 and $20\frac{1}{4}$, Brentford old 249 (a rise of 2), ditto new 190, Brighton original 220, British 41 special, Tottenham "B" $100\frac{1}{4}$, Wandsworth "B" from 133 to 130, and West Ham 104. In the Continental group, Imperial was 1 higher, with business at from $170\frac{3}{4}$ to 172. Union was not dealt in; and European fully-paid marked $23\frac{1}{4}$ special. Of the undertakings of the remoter world, Bombay changed hands at $6\frac{5}{8}$, Buenos Ayres at from $11\frac{1}{8}$ to $11\frac{3}{8}$, Primitiva at 7, ditto preference at $5\frac{1}{16}$, ditto debenture at 94, River Plate at from $12\frac{7}{8}$ to $13\frac{1}{8}$, ditto debenture at 95, San Paulo at from $12\frac{5}{8}$ to $12\frac{13}{16}$, Cape Town debentures at $50\frac{1}{4}$, and ditto debenture at $95\frac{1}{4}$.

ELECTRIC LIGHTING MEMORANDA.

The London County Council Bill—Preamble "Not Proved"—Justice or Partisanship—A Review of the Council's Proposals—Competition and the Necessity for Diversified Loads—Some Points to be Remembered—Edison's Prophecies.

The London County Council have not succeeded with their Electricity Supply Bill; and we do not think the majority of the members will be much perturbed over the matter. The strange thing, however, is that the Hybrid Committee, to whom the House of Commons had referred the measure rejected it last Wednesday morning without hearing the opponents' cases. This fact appears to indicate that it was not upon the merits of the scheme as modified by the Council, but upon the abandonment by the Council of the principle of direct control and management, and the proposed transference of powers to private enterprise, that the Committee founded their determination. It was true that the Committee conferred in private before delivering their decision; but the fact that they did so is not proof of anything in particular—not even of a farce, a blind, or a serious discussion of the *pros* and *cons* of the case. Anyway, the decision came as a great surprise not only to the promoters but to the opponents. The matter is referred to in our editorial columns, and so need not be further discussed here.

However, between the rejection of the Bill and the last opportunity we had of alluding to the proceedings before the Hybrid Committee, a mass of instructive evidence was given, from which (to complete our review of the chequered career of the Bill) a few points may be drawn. The mandatory instruction of the House to the Committee obliged the County Council to insert the conditions in the Bill which it was proposed should be observed by the Council and the transferees. If no transfer or assignment of the powers granted were made within a year from the passing of the Act, then the powers it was suggested should lapse; and such an event the County Council thought might be regarded by

them as a warning against their taking up the supply. Had the Bill gone through, any transfer or assignment it was intended should be by deed, approved by the Board of Trade. The transferees, too, were to be confined to the sites at Barking and Erith (the latter was afterwards dropped); the generating-stations were to be constructed and equipped in accordance with designs and specifications incorporated in the deed; electrical energy was to be supplied within the time specified in the Act; the maximum prices to be charged for electricity were not to exceed those specified in the Act, or for the time being in force under any revision, which revision was to take place at the end of ten years, and at the end of every subsequent seven years; the amount of the dividend was to be regulated by the prices charged; and (this was the objectionable clause to which we have previously given consideration) a proportion of the surplus profits beyond the standard dividend was to be paid to the Council, and be applied for the benefit of the ratepayers in the area of supply. The primary object of the scheme was a cheap supply of electrical energy; and this condition would, in our opinion, have assisted in baulking the attainment of the cheapest supply.

The proposals as to price were based upon the principle that the consumer should pay a fixed sum per annum per kilowatt in respect of the standing charges, with a special low price per unit of electricity used—this being regarded as the fairest method of apportioning the standing charges incurred in meeting a consumer's possible maximum demand, and in this way the higher a consumer's use of electricity, the cheaper per unit his electricity would become. Thus the scheduled terms of supply were as follows: To authorized distributors: High pressure, £3 15s. per kilowatt per annum, *plus* 0·22d. per unit; transformed alternating, £4 7s. 6d., *plus* 0·25d. per unit; low-pressure direct, £5 12s. 6d., *plus* 0·27d. per unit. To power users: Transformed alternating, £5 5s., *plus* 0·3d. per unit; low-pressure direct, £6 15s., *plus* 0·33d. per unit. These are the prices; but their profitableness would, of course, depend on a phenomenal condition of business development. The County Council have their own generating plants for tramway purposes. Railway companies who may convert their systems to electrical traction would prefer to have their own plants rather than put their trust in an extraneous source of supply over which they had no control. The electrical dreamers thought otherwise, and were also contemplating that the power users of London were going to forsake all other means of obtaining power, and glide with the minimum of resistance into the electrical net. The existing electricity undertakings of London do not share such optimism; and the Moderates of the County Council, and the ratepayers whose mandate they were observing, could not see things in the same glowing light as the aforesaid electrical dreamers, or there would have been no question of the transferring of powers. It is computed that there are at the present time in industrial establishments in London 370,000-horse power in use—steam, gas, hydraulic power, &c.; and this would provide a sufficient demand to utilize 180,000 kilowatts. No doubt this is so, if the users of the power would all consent, for the benefit of such an electricity undertaking, to scrap their plant, and use electrical driving in its stead. But would they all do this? The answer is a pretty sure one, notwithstanding a provision of £150,000 being made in the estimates to facilitate the hire-purchase of electric motors. The first generating-station to be put up, it was proposed, should be at Barking. This Barking station, it was intended, should have a capacity of 120,000 kilowatts, and an overload capacity of 180,000 kilowatts. Therefore, with the tramway supply provided for, the railway companies having a preference for their own supply, and the existing Borough Council and Company suppliers preferring to make their own plants more lucrative by developing them as opportunity served, and the power users not being of one mind as to the advantages of electrical driving, the profitable prospect for the first section of the Barking station did not look as though it would be a bright one for at any rate many years to come. During the proceedings before the Committee, the now stale evidence as to large units, water carriage, availability of water for condensing purposes, and so forth being essential for cheap production was shaken out with care before the Committee. But what is really essential for cheap production is the business to keep large units of plant going.

There is another point. Competition in electricity supply in London exists in Bermondsey, in parts of Camberwell, Chelsea, Finsbury, Greenwich, Lambeth, and Southwark, and in the Cities of London and Westminster. Now, the scheme embodied in the Bill was going to commit the whole electricity supply of London to competition; and competition in such supplies as gas and electricity can have (history shows) but one effect. The scheme did not intend to compete for lighting, except in so far as up to 20 per cent. of the current used in industrial establishments might be employed for lighting purposes. But applying to our reasoning the statements of Mr. J. H. Rider, the Council's Electrical Engineer, the scheme would have worked mischief among the existing undertakings by depriving them of something necessary to their well-being and best service. The argument is crystallized in one of Mr. Rider's precepts: "In order to obtain a large load-factor, the load dealt with by a station must be of a diversified character." The scheme contemplated the depriving of the existing undertakings of that day and summer demand which contributes diversity to their load; and, therefore, the lighting consumer was to be made to suffer for the power consumer.

But leaving aside that point, there were other statements in Mr. Rider's evidence which we may place among our *memorabilia*. Here are examples: "For electric heating a cheap supply would be popular. At present, it does not pay to adopt electric heating at existing lighting rates; and even power rates are none too low to ensure a rapid increase in the demand." He also thinks that, to some extent, "current is now supplied for power at the cost of those who take it for lighting." Again, "in many cases the authorized distributors have treated the power load as a sort of bye-product, and have been able to charge low rates because they have kept up the price for private and street lighting; whereas in my view all should be charged on a common basis—that is to say, each kind of supply should be charged in accordance with its proportion of standing charges and running costs." These are points well worth remembering.

Mr. Edison has been a great inventor, and he has been great at prophesying; but his predictions have not always come off, though to tell the truth some years ago they somewhat upset the nerves of numerous shareholders in gas undertakings. If there are any such nervous shareholders now, and they believe in Mr. Edison as a prophet, they had better take steps to clear out their holdings. They will find a free market for them. Not only gas shareholders, but proprietors in all industrial businesses turning out mechanical appliances that are not worked electrically, are warned—by Mr. Edison. It is a little too soon, however, to think of converting those businesses into electrical ones, as the makers of electrical plant are already rudely jostling each other to such an extent that they are not having a very comfortable time of it. However, if the proprietors in the businesses that are not of the elect believe in Mr. Edison, and they turn to the production of electrical machinery for the good time that is said to be coming, they must blame him if this does not turn out as they would desire. Mr. Edison is now 61 years of age; but he admits that he knows now very little more about electricity than he did at the start. Nevertheless, he expects to see at an early date the direct generation of electricity from coal by a cheap process. Then the electrical industry will be in its heyday, and many other industries will sink into oblivion. Locomotives will be thrown on to the scrap-heap, which will be a very big one. All trains will be run by electricity. A large portion of the goods traffic of the railways will be taken from them, much labour will be dispensed with, and the workhouses will be filled (for no longer will coal be laboriously transported to our cities). Great power plants will be established at the pit's mouth, from which electricity will be sent all over the country by wire. There will be no horses in the streets, no stables required, no "flies" (the wheeled variety) needed, waggons will be propelled by electricity, ships will no longer be driven by steam, and houses (oh, terrible thought!) will be lighted entirely by electricity, for it will be so cheap that it will be used even by the humblest tenement dweller. Hence there will be more than locomotives and cabs for the scrap-heap. Extensions of gas plant had now better be stopped, and further research in the gas industry need not be entered upon—for the Prophet Edison has spoken.

Transferred Members of the Institution.

At the annual meeting of the Institution of Gas Engineers it is customary to announce the names of those who have been transferred by the Council during the preceding twelve months from one class of membership to another. This was not done at the recent meeting; but we have since received from the Secretary (Mr. Walter T. Dunn) the following names of associate members transferred to the class of member:—

Gibson, R. E.	Liverpool.
Goodenough, F. W.	Westminster.
Greenaway, Reginald	Bodmin.
Hulme, Charles	Uxbridge.
Morton, Philip	Genoa.
Nuttall, L. W	Gosport.
Saville, H. W.	Drogheda.
Shadbolt, Samuel	Kirkby-in-Ashfield.

It is reported that a discovery of monazite earth has been made on the Eleanor River, 28 miles west of Kingscote, South Australia. Some people who were prospecting for gold found that the soil contained monazite, which separated from the other constituents of the soil comparatively easily, yielding a paying percentage of thorium oxide.

The Council of the Society of Arts are prepared to award, under the Fothergill Trust, a gold medal or a prize of £20 for the best portable apparatus or appliance to enable men to undertake rescue work in mines or other places where the air is noxious. It is intended that the apparatus sent in shall be submitted to practical trials and tests. In the award of the medal, regard will be had, first of all, to excellence of design and contrivance; and, secondly, to excellence of manufacture. Inventors intending to compete should send in a notice of their intention, together with a full description of their inventions, not later than March 31, 1908, to the Secretary of the Society, John Street, Adelphi, London, W.C.; and in cases in which the apparatus has been put into actual use, the experience of such use should be given, and the special points of merit of the apparatus indicated.

GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS.

REVIEW OF THE PROCEEDINGS (Continued from Vol. XCVIII., p. 1003).

On another page is given an abstract translation of Herr Kobbert's paper on "Questions as to the Limitations of Gas Supply, and their Solution." A summary of Dr. Bunte's lecture on the "Combustion Phenomena of the Inverted Gas-Burner" also appears to-day. These are the only remaining communications relating to gas supply of which it appears necessary to give a detailed report. The papers dealing with water subjects, which were read at the meeting on Thursday, June 13, should, however, be briefly noticed before giving a summary of the reports of the several Committees.

Water Supply Topics.

Herr O. Smreker, of Mannheim, gave an exhaustive address, elucidated by maps and diagrams, on the "Hydrological Investigation of Underground Water Areas, with Special Reference to the Vicinity of Mannheim." He began by pointing out that it was no longer thought sufficient to know that the quality of underground water intended for a town supply was at the time unobjectionable; it was rightly considered necessary to prove that it would continue unobjectionable for the future. When he, in 1882, had to consider the question of the supply of Mannheim with water, different opinions prevailed. Owing to the great distance of the hilly country from the town, springs in the proper sense of the term were out of the question as a source; and it became necessary to choose between underground water and the river (Rhine) water. Trial borings were made in the plain of the Rhine and in the Neckar valley; and it was found that on the north of the town there was a strong flow of underground water from the mountains to the Rhine. This water had the requisite degree of hardness, and was otherwise unobjectionable.

The next paper was by Herr Gross, of Stuttgart, on the "Means of Water Supply in Würtemberg." It described how, since 1870, schemes for the supply of water, not only to single towns, but to groups of places, had been adopted, until at the present time there are in Würtemberg 29 works serving groups of places. These works supply 378 communities.

Mr. W. H. Lindley, of Frankfort-on-the-Maine, then delivered an address on the "Discovery of Sources of Supply for the Water Supply of Large Towns on a More Scientific Basis." He described graphically different methods of water supply adopted in a number of towns in the East and elsewhere—as, for instance, Bucharest, Baku, and Tiflis—and the different classes of water used. In Tiflis, the water came out of the rock. Lodz, the large industrial town in Russian Poland, did not stand above any water. The conditions of supplying water were very difficult in that case; but exhaustive geological investigations had proved that there was to the south-west of the town a big band of oolite with extensive springs. Common sense and a proper training in physics and geology would, he said, accomplish much more than human magnetism. The speaker's remarks, which were punctuated with touches of humour, were very well received, and were favourably discussed by a number of water engineers.

Dr. Kolkwitz, Professor at and Member of the Royal Experimental and Testing Institute for Water Supply and Drainage at Berlin, read the next paper, of which the subject was the "Biology of Springs and Wells." He pointed out that, in addition to the animal organisms in water, there were vegetable organisms to be considered. He referred to the different varieties of mould and fungus. There were series of interesting organisms in most shallow wells and old watering-places; but organisms were also to be found in artesian wells.

The Technical Committees' Reports.

Passing from these papers on water supply, it will be convenient next to refer to the reports of the various Technical Committees appointed by the Association, and to take them in the order in which they have been issued, rather than as they were presented as occasion arose at the meeting in the intervals between other business.

The report of the "Committee on Photometry" was presented by its Chairman, Dr. W. Leybold, of Hamburg. A digest of this report was given in the "Journal" for June 18 (p. 812). The Chairman brought forward a motion to the effect that the Committee should be authorized to make an investigation as to whether, and in what way, the rules adopted by the Union of German Electro-Technicians for the photometry of arc lamps could be applied in principle to outdoor gas lighting. The motion and the report of the Committee were adopted; and a sum of 900 marks (nearly £45) was allotted for expenses during the ensuing year.

The report of the "Committee on Heating" was also summarized in the "Journal" for June 18 (p. 812). It was presented by its Chairman, Dr. Schilling, of Munich. The Committee intend to participate, so far as heating by gas is concerned, in the forthcoming Congress on Hygiene and Demography at Berlin. The Committee were allotted 2000 marks (nearly £100) for expenditure in the ensuing year.

The report of the "Committee on Gas-Meters" was presented by the Chairman, Herr C. Kohn, of Frankfort-on-the-Maine. A digest of this valuable report is given on another page of to-day's issue. The Committee were financed to the extent of 600 marks (nearly £30) for the coming year.

The report of the "Committee on Water Statistics" was presented without discussion by Herr Reese, of Dortmund; and a grant of 3800 marks (nearly £190) was made for expenses during the ensuing year. A summary of the report will appear in due course.

The report of the "Committee on Working of Water-Works," which was presented by Dr. Wellmann, of Charlottenburg, gave rise to some discussion as to the collection of statistics on the use of the divining rod. The Committee have now collected a vast amount of information concerning cases in which the divining rod has been applied; and it is proposed to classify this and publish a summary shortly. The Committee were allotted 600 marks (£30) for work next year.

A valuable report was presented on behalf of the "Committee on Earth Currents," by Mr. W. H. Lindley, of Frankfort-on-Maine, who stated that collaboration with the Union of German Electro-Technicians and the Association of German Tramway and Light Railway Offices had proved very satisfactory. He had been elected Chairman of the Joint Committee of the three bodies. A sum of 7000 marks (nearly £350) was placed at the disposal of this Committee for investigations during the coming year. The report in a condensed form will appear in a later issue, and is well worthy of perusal.

The "Committee on Instruction" presented, through Herr Ries, of Munich (in the absence of the Chairman, Dr. W. von Oechelhaeuser, of Dessau), a report, of which a digest is already in type. In some points, it overlaps the important report of the Committee on the Association's Instructional and Experimental Gas-Works, on which a special article is in preparation for the "Journal." This report was presented by Dr. Bunte, who took the opportunity to explain that when discussing the merits of the Munich carbonizing chambers and vertical retorts in the course of the first day's proceedings (see "Journal," Vol. XCVIII., p. 811), he had not intended to indicate that he considered the Munich chambers superior to vertical retorts in themselves, but only to vertical retorts with continuous working such as were being tried in England. The Instruction Committee received a grant of 750 marks (nearly £37 10s.) for the ensuing year; and the Instructional and Experimental Gas-Works 21,500 marks (nearly £1075).

The only other report was that of the "Museum Committee." A sum of 1000 marks (nearly £50) was placed at the disposal of this Committee for use during the coming year.

(*To be continued.*)

MANCHESTER GAS EXHIBITION.

The arrangements for the Manchester Gas Exhibition, which is to be opened on Oct. 23 next, are now in an advanced state. The Advisory Committee are desirous that it should be generally known, not as a Gas Lighting Exhibition, but as an "Exhibition of Light, Heat, and Power from Gas;" and efforts have been made to secure special exhibits of plant using gas in manufacturing operations—such as gassing frames (using high and low pressure), hatters' machinery, tinmen's stoves, glass blowing, and other interesting processes for which gas can be, and is being, utilized. Promises of assistance have already been received, provided satisfactory arrangements can be made as to power. Negotiations are now in progress to this end; and there is little doubt that they will be successful. The Advisory Committee have also been able to secure the assistance of the Manchester Corporation Gas Committee, who will meet all exhibitors handsomely in the laying of pipes in the hall, and in the charge for gas; the Chairman (Alderman Gibson) having promised a rate lower than, or as low as the present power rate. A large number of street-lamps in Oxford Street and the adjoining streets will be placed at the disposal of the Committee, on which exhibitors can show their latest productions in street lighting lanterns and burners.

The allotment of the stands is in the hands of a Sub-Committee acting with the Manager; and all the best places are now let. The following is a complete list of the firms who have definitely completed their contracts for space with Mr. Cawood, and have had their stands allotted.

Anderson and Duffield	Cannon Iron Foundries
A.V.I.L. Company	Carron Company
Arden Hill and Co.	S. Clark and Co.
George Bray and Co.	Davis Gas-Stove Company
Bever and Wolff	Flexible Metallic Tubing Co.

Fletcher, Russell, and Co.
Bland and Co.
Thomas Glover and Co.
S. Gratrix, Jun., and Bros.
Hayward and Co.
Imperial Stove Company.
James Keith and Blackman Co.
D. D. Macpherson and Co.
R. & A. Main
Thomas Marsh
Moores Makinson and Co.
Parkinson and W. & B. Cowan
New Hygienic Stove Company
Planet Foundry Company
Pneumatic Gas Lighting Company
A. E. Podmore and Co.
Ramie Company
Richmond Gas-Stove and Meter Company
J. Russell and Co.
J. Stott and Co.
Welsbach Company
Wholesale Fittings Company
J. E. Williams and Co.
Wilsons and Mathiesons
John Wright and Co.

In addition to these, there are eleven firms who have not yet completed their contracts, and whose space has not yet been arranged. These include several gas-engine makers, the special process machinery makers mentioned before, and two important lighting firms. When these are completed, more than five-sixths of all the available space will have been taken.

A Sub-Committee have in hand the lighting and ventilating of the hall; and offers are now received for both, and will be considered shortly. Another Sub-Committee have under their charge the organization of, and arrangements for, lectures and competitions; and they will be assisted in both by a Committee of the gas-stove makers. Arrangements are in hand for popular lectures on the use of gas. There will be special lectures to architects, builders, plumbers, and gas-fitters, and cookery lectures and competitions for school-children.

Circulars are now ready for sending out to manufacturers of gas-works plant, and testing apparatus and scientific instrument makers, stating that a large space has been reserved for models which will be received, staged, exhibited, and explained free of charge to those sending them. As there is not the least doubt that the exhibition will be visited by everyone interested in the manufacture, distribution, and testing of gas and its products within fifty miles of Manchester, it should benefit everyone in the profession.

The Chairman of the Advisory Committee (Mr. Thomas Newbigging, M.Inst.C.E.) or the Hon. Secretary (Mr. H. Kendrick, of Stretford) will be pleased to give all information or answer any query as to the scope and arrangements of the exhibition; and Mr. W. Whatmough, of Heywood, one of the Joint Hon. Secretaries to the Committee, will be glad to do the same with regard to the lectures and lighting, as from now he will take over the duties as Hon. Secretary to these two Sub-Committees.

NOTES FROM WESTMINSTER.

THERE is not much stirring in the Committee Rooms just now; but notes upon a few points are made in the succeeding paragraphs. The consideration by a House of Lords Committee of the Bill of the Hull Corporation for the purchase of the East Hull Gas Company's works is near in hand; and we look for the result before the end of this week, hoping and expecting that the Lords will refuse to endorse an expropriation of property for which there is no reasonable excuse. During last week, the London County Council Electricity Bill met with a premature end, at the hands of the Hybrid Committee of the House of Commons; but in view of the allusion to the matter in the editorial columns and in the "Electric Lighting Memoranda" to-day further reference is omitted in these notes.

Annfield Plain Gas Bill. The Annfield Plain Gas Company's Bill was pursued by the Annfield District Council to the House of Lords. The measure was under the consideration of a Committee last week, with the result that the position of the questions involved (with one exception), and of the Bill itself, remain unchanged. The success of the promoters has been, with the one exception, complete through both Houses; and we are not disposed—in view of the state of the gas supply in the district, and the work that has to be done to put it in a proper condition, to give the best possible service to the people—to in any way question the verdict of the two Houses. But with regard to the exception, the consideration we gave to the Bill at the time it was before the House of Commons was directed by the terms of the measure as originally printed; and our knowledge was short of the one and important point that the promoters had subsequently introduced a clause which would have considerably curbed the arbitrator in determining the sum the Gas Company were to pay to the vendors Messrs. Schultz and Comins for the property and the works executed by them, and which might (we do not say would) have given them more than the fair value of the property—to the detriment of the gas consumers. The liberal terms of the inserted clause were, in fact, such that the vendors had, up to a point, virtually constituted themselves both vendors and arbitrators as to the sum they should receive. That has now been altered; and the direction to the arbitrator is that the purchase price shall be the total of the actual sums paid by Messrs. Schultz and Comins for the lands, gas-works, and property, and the cost and expense of, and incident to, the acquisition thereof, together with the fair value of all works executed by them since they themselves acquired the property. The purchase price is to be determined by a single arbitrator, to be appointed, on the application of either party within three months after the passing of the Act, by the President of the Gas Institution, in accordance with the Lands Clauses Act.

Metropolitan Water Supply. Several Bills affecting water supply have lately finally moved from the Committee stage. There is the Metropolitan Water Board's (Various Powers) Bill, which is a measure of very extensive purpose. Amendments were made in parts and new clauses inserted as the result of the opposition of interested parties. But the main point of the measure, which stands intact, is to confer upon the Board further powers for providing for the safety of the supply to the Metropolis. In an undertaking of such immensity, there must be here and there weak spots; and it has been the business of the Chief Engineer (Mr. W. B. Bryan) to detect these. The Board are in very safe hands. One of the important mains upon which the Board have to rely for an equally important part of their supply is, in its single existence, a source of jeopardy in the event of an accident to it; and the Bill will give power to relieve the Board from sole dependence upon it in respect of the supply it conveys. The Board have also a scheme in hand for the construction of what is to be known as the Island Barn reservoir; but several of the local authorities and landowners in the neighbourhood of the site are not at all friendlily disposed to the reservoir. They therefore opposed the Bill. But self-interest had to give way (as it always must do) to public necessity. After the revision of the Bill, the preamble was declared proved. The Joint Committee of both Houses have also concluded their consideration of the Board's Charges, &c., Bill; and it has been sent forward. The principal proposal of the measure is, it will be remembered, the equalization of charges in the area of supply; and this was agreed to before the long and critical examination of clauses was entered upon. At the time a little comment was made in these "Notes" on this feature of the measure.

Repayment of Water-Works Capital. In the case of water-works of considerable magnitude, which occupy some years in construction, there must be, on the part of Parliament, a benevolent latitude in the matter of the period from which repayment of capital must commence, seeing that the large sums required are borrowed at various periods as the works proceed and are long in becoming remunerative. Birmingham has nothing to complain about regarding the considerate treatment that Parliament has meted out to them in connection with the large water-works which they obtained power to build in 1892. But at the same time, we cannot in 1907 understand why fifteen years have been allowed to elapse before the Corporation have secured the sanction of Parliament to such a reasonable matter. The money authorized in 1892 amounted to £660,000; and the period of repayment was named as 60 years, with a suspension of the sinking fund for ten years—that is to say, to the end of March, 1903. In 1902 the sinking fund was further postponed for six years. But some of the money has been borrowed as recently as last year. Now the Corporation are asking Parliament to spread the payments to the sinking fund according to the dates of the loans—in other words, to date the sixteen years' suspension from the time each debt was originally incurred. Parliament has seen no difficulty in acceding to the request; and so the Bill goes forward, and the Corporation and ratepayers will be happier than before. This question of repayment also came forward in connection with the Tees Valley Water Board Bill, referred to in a subsequent paragraph.

Protecting a Railway Company. There was only one opponent when the Southport, Birkdale, and West Lancashire Water Board's Bill was called before the House of Commons Committee presided over by Sir Joseph Leese. The Lancashire and Yorkshire Railway Company were desirous that the Board should obtain their consent before water-mains were laid under their property. But the Board, on their part, would not voluntarily assent to this. The Railway Company, however, did not take up any dog-in-the-manger attitude, but were willing that any difference should go to arbitration. Thus it came to pass that it was agreed that, in the event of difference, the matter should be submitted to an arbitrator appointed by the President of the Institution of Civil Engineers.

Tees Valley Bill. The Tees Valley Water Board Bill has not had to meet any serious hostility in the House of Commons; the brunt of the opposition the Bill originally provoked having been met in the House of Lords. There were only two manufacturers in opposition on the question of the proposed increase in the charges for trade supply from 3d. to 4¾d.—an increase that most of the ironmasters agreed to pay. The ratepayers on Teeside have of late years had a fairly heavy burden to bear in connection with their water supply; and this relief will be welcome. Another point secured is that the sinking fund on the expenditure for the Grassholm reservoir has been suspended until 1914. Although this is opposed to the recent practice of the Local Government Board—viz., to compel the payment of interest and redemption from the period of new works being started—it seems only fair that redemption should date from the time, and not before, the works become operative.

Water from the Bure. The Great Yarmouth Water Works and Lowestoft Water and Gas Bill, which incorporates the powers for a joint scheme for taking water from the River Bure, is again being opposed by the Yarmouth Corporation in the Commons; but the proceedings before the Committee

have not yet been completed. The whole question was thoroughly well discussed in the Lords; and the evidence that is now being tendered lacks one thing, and that is freshness. As a matter of fact, it is difficult to see what can be said upon the matter that can be honestly described as new.

THE LIMITING CONDITIONS WITH GAS-WORKS.

The following is a summary of the points dealt with by Herr Kobbert, of Königsburg, in his rather long and speculative paper, at the recent meeting of the German Association of Gas and Water Engineers, dealing with the conditions which limit the extension of the supply from gas-works.

He began by pointing out that there still remained a very wide field over which the operations of gas undertakings could be extended. This was especially the case if gas-works were regarded as central stations for the supply of heat; and he proposed to discuss their limitations from this aspect. As to their limitation for the supply of light, it was wrong to assume that there was any limit. The question was not one of gas *v.* electricity, for electricity was merely a secondary—frequently only a tertiary—form of energy, while gas was a primary form. Gas lighting was still only in course of development; and it must be conceded that gas would be capable of fulfilling, either directly or indirectly, every requirement in regard to lighting.

The field of supply of gas for cooking was still far from filled. For example, if a town of 220,000 inhabitants were in question, it would have taken for cooking purposes in 1905 (say) 198 million cubic feet of gas. But when all the cooking there should be done by gas, it could be calculated that no less than 550 million cubic feet of gas would be disposed of by the gas-works for this purpose in a year. The extent of the use of gas-cookers was only about 55 per cent., and was still far behind that of bath-water heaters, &c. In regard to the heating of dwelling-rooms, the extent of heating with solid fuel from central stations as compared with that of separate fires, indicated that there was greater room for its extension than for gas heating. But with sufficiently large stoves, there was also room for more extended use of gas in this direction. If we allow only two gas-fires for each house with more than four rooms, the gas consumption for heating in a town such as has been mentioned would amount to 304 million cubic feet per annum. This town consumes about 90,000 metric tons of coal for domestic, and about 100,000 tons for industrial purposes. The heat afforded by the latter could be obtained by a consumption of about 3700 million cubic feet of gas only.

Herr Kobbert went on to say that such a capacity could be most properly attained by a simplification of the buildings and apparatus for gas-works, and by effecting a better recovery of the bye-products. To this end, the washing of the gas should be carried out by means of Feld's apparatus* as made in Germany by a firm at Zehlendorf, near Berlin. This apparatus had been installed at Königsburg, and was giving very good results. For instance, 98 per cent. of the ammonia was recovered from the gas with sulphate of lime only; and thus without the intervention of any intermediate process a solution of sulphate of ammonia was obtained. Ammonia was thus recovered from the gas much more economically. By this method, 4 million cubic feet of gas could be washed on the space allotted to only 1¾ million cubic feet per diem with washing apparatus of the ordinary type.

In order to equalize the fluctuations in consumption according to the coldness of the winter, Herr Kobbert recommended the gas industry to turn to closed coke-stoves, which could be heated with coal gas as well as with coke gas or water gas. In this connection, he referred to a communication recently published, in which Mr. Schlicht (at the Society of Arts) recommended gas-works to further the use of close coke-stoves, only that more coke might be used for heating rooms.† The author, however, proposed also to use this coke in a suitable gaseous condition in small towns. Thus towns would not only be freed from soot and smoke, but also be relieved from sulphuric acid. He supported his views by quoting a great number of statistics, and stated his opinion that gas having a net calorific value of 450 B.Th.U. per cubic foot at 59° Fahr. could quite well be sold for 2 pfennige per cubic metre (6·8d. per 1000 cubic feet). In regard to the hygienic improvement which would ensue from such a gas supply, the author quoted the views of Rubner, Ascher, and Renk. He did not put forward his ideas merely as interesting dreams; they were rather earnest and sober calculations.

* See "JOURNAL" for April 9, p. 85. † *Ibid.*, May 14, p. 454.

Reinforced Concrete Tests.—Reinforced concrete tests made at the University of Wisconsin testing laboratories during the past four years indicate that concrete cracks before evidences of the break can be detected by the eye; and that after it has cracked, though only minutely, its strength in tension is zero. Comparative tests of reinforced and plain concrete bars made at the University show that the first indications of cracking appear on the reinforced beams at about the same load as that at which the plain beams fail. It is therefore considered probable that concrete reinforced with steel will not stretch more before cracking than plain concrete, and that consequently the tensile resistance of concrete should not be taken into consideration in reinforced concrete design.

THE ADJUSTMENT OF THE GAS SUPPLY TO INVERTED BURNERS.

The New "Nico" Adjuster.

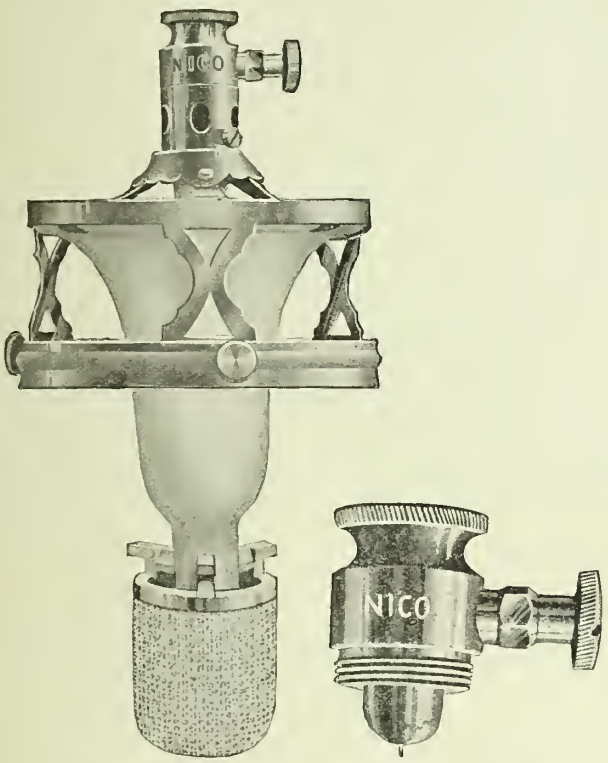
There were many good points in the paper read by Mr. Harold E. Copp, of West Bromwich, on "Incandescent Gas Lighting, with Special Reference to Inverted Burners," at the Dublin meeting of the Institution of Gas Engineers. But there was one statement in it to which we wish to take exception. He was speaking of the adjusting of the gas to inverted gas-burners; and, in this connection, averred that a needle valve in which the gas issues from an annular space tended to lower the efficiency, in comparison with adjusters in which the hole is maintained fairly circular in form. He went further, and announced his preference for dispensing, as far as possible, with the use of mechanical adjusters; declaring that he finds that it is generally more satisfactory, when making installations of incandescent burners—especially of the inverted type—to take a record of the pressure at the point where the burners will be fixed, and to adjust them to these exact conditions in the test-room before they are sent out. But turning to the discussion, it is seen that Mr. W. R. Herring combated both points in the statement—asserting that he finds the burner with the type of adjustment condemned by Mr. Copp gives the best efficiency, and suggesting that it is practically out of the question to take the pressure at any position in which a burner is to be fixed, and to exactly regulate the burner prior to fixing for that position. Mr. Herring added that it is physically impossible to know what the pressure will be in any particular locality at any given time, unless every house is governed independently of the street-mains; and further, the success of a system must not depend on the adjustment of a burner for the position it has to occupy, but burners must be of such a character as to meet all varying conditions to be found at the present time.

These statements, diametrically opposed as they are, and coming from two practical men, are interesting; but of the two, our views are entirely in accord with those of Mr. Herring—practical experience over some months having been obtained from trials of a new form of gas-adjuster, known as the "Nico," that the New Inverted Incandescent Gas-Lamp Company, Limited, are now placing on the market. However, dealing first with the question of pressures, it is absolutely impossible, as Mr. Herring points out, with all the various disturbing influences that affect pressure throughout the distribution network, to assure constancy in pressure of the delivery at any house, unless that house be specially governed. Assuming that it is so governed, there again come in the disturbing influences inside the house, through the variations in the numbers of points of lighting, and through the intermittent use of gas-fires and cooking-stoves, all of which make it practically impossible to so adjust a burner at any given position at the time of installation so that the burner will need no further adjustment. In the very room in which this article is being written, the gas for the desk light is furnished by a branch from a pipe supplying a gas-fire, and the pipe supplying the gas-fire is taken from one supplying a cooking-range in the scullery on the ground floor. In the same house, a bed-room gas-fire derives its supply from the same pipe that feeds a pendant in the dining-room. These are not extreme instances of the gas-piping arrangements in a house; and how, we ask, is Mr. Copp's preference for adjusting his inverted burners before installation to apply to fittings subjected to such fluctuations of gas pressure as is produced in a house by gas fires and a cooker? Before the use of the "Nico" adjuster on the desk inverted burner previously referred to, the fluctuations of light were considerable, owing to the vacillating supply pressure; but the adjuster has given such ease of instant regulation while the burner is in use, that a uniform illuminating power is now readily maintained. Pressure, too, is not the only disturbing factor; there are the mutations in the composition of the gas, especially where water gas is mixed with the coal gas in varying proportions according to varying demand. Experience therefore leads us to agree with Mr. Herring, that what is wanted is a burner of such a character as to meet all the varying conditions in supply at any point; and the nearest approach to such an ideal burner that is procurable to-day is one fitted with a positive and sensitive mechanical gas-adjuster. Regarding the point as to such adjusters lowering efficiency, we will deal with that towards the close of this article by quoting some authoritative tests.

Previous to the advent of mechanical gas-adjusters, the only means of regulating gas and air supply were by the gas tap and the collar by which the primary air supply was controlled. But with a really good mechanical gas-adjuster, the air-supply holes need no regulation (within, of course, reasonable limits). The gas-tap and the air-collar are at the best crude, cumbersome, and unsatisfactory means of adjustment—particularly for inverted gas-burners. They lack the essential refinement; and it is the mechanical gas-adjuster that has proved this by the increased efficiency that is, as a matter of fact, realizable by its use. It is the fine adjustment of the proportion of gas to the air supply that this means of regulation affords—at all times, and under all conditions—that ensures the complete combustion and the fullness of flame temperature which cause the mantle, under the conditions of use, to render its maximum duty.

The construction and the reliability of a gas adjuster must, of

course, be of great importance in the production and maintenance of efficiency by its application ; and it is found that the new patent "Nico" regulator is constructed on such scientific principles that a perfect jet is realized, and it is also so strongly yet simply made that its refined movements are not in any way affected (writing after an experience of three or four months) by the heat or other influence to which it is subjected by the position it occupies above the burner. It is not found that the velocity of the gas is in any way impeded ; but it is found that the hole through which the gas is injected permits the gas to pass in a hollow or crescent shaped jet, which practical trial pronounces preferable to a solid stream of gas. We anticipate that research would find that the reason for this is that such a jet sets up an eddying motion in the bunsen tube, and thus plays its part in the securing of a perfect mixture. The eccentric action of the crank on the inside cylinder of the adjuster makes it impossible for the



The "Nico" Gas-Regulator, shown fitted to, and separate from, Burner.

needle to become tight ; and the experience is (as previously mentioned) that, after some months' continuous use, the same sensitiveness of the regulator to the slightest touch obtained at the beginning of use is preserved. This is a very essential condition with regulators of the kind named; for they must not be a source of worry to the consumer, or their frailties would bring the incandescent system itself into disrepute. Another essential in connection with such regulators is that they must not be the seat of small but nasal-offending escapes of gas. We have found the "Nico" regulator to be absolutely innocent in this respect; and, as a matter of fact, between the operating spindle (on the end of which is a milled head for facilitating the movement by hand) and the body of the regulator a spring is placed, which renders it perfectly gas-tight. The new gas-adjusting fitment takes the place of the ordinary injector; and therefore the burner is not greatly lengthened by its use.

There are other points which might be dwelt upon in praise of such mechanical regulation as that afforded by this new "Nico" adjuster ; but we will not burden this article by going into them. The two outstanding advantages of such an adjunct to the incandescent burner are: (1) Its universality in application—that is to say, its suitability (without special nipples) for any pressure, for gas of any composition, and therefore for any town, premises, or position; and (2) its efficiency-producing capability, through the refinement ensured. It places in the hands of the consumer the convenience of a ready means of adjustment while the burner is in use, and of keeping the aperture in the injector clear without injuring that aperture by the rough application of such clearing instruments as pins, to the detriment of results.

With regard to the efficiency of the burners fitted with the "Nico" adjuster, Messrs. Alexander Wright and Co., Limited, have made a series of photometrical tests for the New Inverted Company, the results of which we are free to publish. The gas used in these tests was stored gas of the Gaslight and Coke Company, containing a proportion of carburetted water gas, and certified at the testing-stations as being of 16-candle power, consumed in the "Metropolitan" No. 2 argand burner. Check tests were made by Messrs. Wright during the progress of the tests to ensure constant quality. The calorific power was also tested by them, and found to be 540 B.Th.U. gross.

The first tests refer to the No. 4 "Nico" inverted burner and the bijou No. 5 "Nico;" both being fitted with the patent adjuster The readings were:

No. 4 New Inverted Burner, with Adjuster.

	60° South.
Consumption	3·4
Illuminating power, candles	65·5
Candles per cubic foot	19·26

Bijou No. 5, with Adjuster.

	60° South.
Consumption	1·3
Illuminating power, candles	30·5
Candles per cubic foot	23·4

In considering these tests, the facts preceding the figures as to the characteristics of the gas supply must be borne in mind. Having regard to these characteristics, the efficiency of the No. 4 "Nico" inverted burner per cubic foot is excellent; and the efficiency per cubic foot of the bijou burner is something worth thinking over in these days when both economy and high efficiency are demanded by the public. Here we have shown an efficiency of 23·4 candles per cubic foot of coal and carburetted water gas of 16-candle power, tested in a "Metropolitan" No. 2 burner.

The New Inverted Company have also been trying the effect of the new patent adjuster on vertical burners; and using the various forms of the Welsbach-Kern burner, Messrs. Wright and Co., in their photometrical tests, have found remarkable improvements in duty per cubic foot—particularly with the lower gas consumption, and with the No. 2 Kern. The figures are so clear that it is needless to point their testimony by remarks of our own.

No. 2 Kern Burner, fitted with Ordinary Nipple.

Consumption	2·9	2·5	2·2
Illum. p., candles	53	44	34·5
Candles per C. F.	18·9	17·6	15 7

No. 2 Kern Burner, fitted with Patent Adjuster.

Consumption	3·4	2 8	2·3
Illum. p., candles.	65	58	47
Candles per C. F.	19·1	20·7	20·04

No. 3 Kern Burner, fitted with Ordinary Nipple.

Consumption	4·3	4·2	3 5	3·2
Illum. p., candles	86·5	80	69	6(
Candles per C. F.	20·1	19	19·7	19

No. 3 Kern Burner, fitted with Patent Adjuster.

Consumption	4·1	3·8	3 6	3·5	3·4	3·03
Illum. p., candles.	82	80	76	73	70	63
Candles per C. F.	20	21	21·1	20·8	20 5	20·8

No. 4 Kern Burner, fitted with Ordinary Nipple.

Consumption	6 24	5·9	5·25	5·1
Illum. p., candles.	114	112	100	80
Candles per C. F.	18·2	19	19	15·7

No. 4 Kern Burner, with Patent Adjuster.

Consumption	5·6	5.25	5·1	4·6
Illum. p., candles.	105	100	97	78·5
Candles per C. F.	18·7	19	19	17

The regulators are also to be made for "C" burners, from which equally good results may be expected.

We are satisfied that the merits and utility of mechanical adjustment, and the improvement and maintenance of burner efficiencies, are abundantly certified by the experiences with the new "Nico" regulator.

ITALIAN GAS SOCIETY'S ANNUAL CONFERENCE.

Among the many annual meetings which have just taken place, we must not omit to record the 36th conference of the "Gasisti d'Italia," which was held in the interesting old city of Bologna during the three days June 17, 18, and 19. Notes of the meeting, kindly sent by one who was present, enable us to give the following review of the proceedings.

Last year there were 135 members of the Society; and bearing in mind the characteristics and distances of the country, it must be considered satisfactory that about half, or 60 of the members, were present at the meeting. They met in the Atrium of the Communal Theatre, the acoustic properties of which—however satisfactory for a concert or opera—proved very defective for a gathering of gas engineers. The first meeting on Monday, June 17, was taken up with purely business and formal matters. The minutes of last year's Conference at Milan, which it will be remembered was more or less of an international character, were approved, and the financial statement passed. The President of the year—Signor Ing. F. Rebuffel, the Manager of the municipal gas undertaking at Bologna—was next installed in the presidential chair ; but, in accordance with custom, this does not involve, as with us, a presidential address. Some new members were admitted to the Society ; and the record was read of deceased members. The Committee for the awarding of prizes to workmen was appointed, and also a delegate for the consideration of the technical papers to be read at next year's meeting, which it was decided later on in the proceedings should be held at Venice. No papers having been prepared for this year's meeting, Sig. Chavannes, who had been nominated last year to deal with them,

had no report to present. This finished the first ten items on the *agenda*, and closed Monday morning's proceedings.

The afternoon was occupied by a visit to the Bologna Gas-Works; and it was a notable feature of this Conference that it was the first time in the history of the Italian Gas Society that their annual meeting had been held under the auspices of a municipal gas undertaking. This gave the visit to the town's gas-works at least a new and distinguishing aspect. There was not, however, anything of particular note to be observed in the manufacturing plant; though, for Italy, there was something of novelty in the manufacture of water gas on the Dellwik-Fleischer process. The plant had, we believe, been installed by the firm of MM. Siry, Chamon, et Cie., of Milan.

The second day's proceedings opened with a discussion on the International Photometric Committee, and Sig. Böhm (of Milan), who is the representative of Italy on the Committee, spoke at length on the present position and future prospects of the question. Following this, a good many members aired their views on the semi-political problem of a compulsory cessation from work once a week. The English holiday of from Saturday noon to Monday morning is receiving a fair amount of imitation. A constitutional question was next raised as to whether water engineers should be admitted to the Society; but its further consideration was postponed until next year. The grievances of taxation are everywhere more or less prominent, but perhaps nowhere more than in Italy; and Sig. Pouchain (of Rome) drew attention to various anomalies which existed—such, for instance, as the taxation of gas-mains but not of water-pipes.

The small town (5000 inhabitants) of Cento, and its little gas-works, built under the engineership of Sig. Calzavara, were visited in the afternoon of June 18. The members met with a hearty reception at the hands of the Municipality, who had provided music and floral decorations for the occasion. In the evening, the Hôtel d'Italie at Bologna was the scene of a very friendly dinner given by the municipal gas undertaking, represented by Sig. Gaetano Giovannini and Sig. Carpi, the President and Vice-President respectively of what we should call the Gas Committee of the Municipality. Sig. Lacombe (of Milan) spoke in French as to the same technical and other difficulties of gas administration being met with by municipalities as by gas companies.

On Wednesday morning (June 19), the subjects of the utilization of bye-products and the possibilities of the distribution of gas for heating were discussed, among others, by Signori Chamard (Florence), Margary (Leghorn), Beria (Turin), Laeng (Brescia), Sospisio (Trieste), and Calzavara (Venice). After methods of meeting the ever-troublesome naphthalene had been mentioned, Sig. Sospisio discussed at some length the question of carburetted water gas from the Italian point of view. He described the various systems in use—carburetting by means of petroleum being the best and most general. But in Italy the question of Customs duties comes in; and this, notwithstanding a recent reduction of duty, makes the price prohibitive. Benzol had to be resorted to instead. Self-enrichment, or auto-carburetting, he regarded very sceptically. Some people even yet thought water gas meant turning water on into gas-mains! Lastly, he combated effectively the popular prejudice as to water gas being exceptionally poisonous and dangerous. After Sig. Beria had also spoken, Herr Rottenbach expounded the merits of Dr. Bueb's system of vertical retorts; but there was no discussion of this topic.

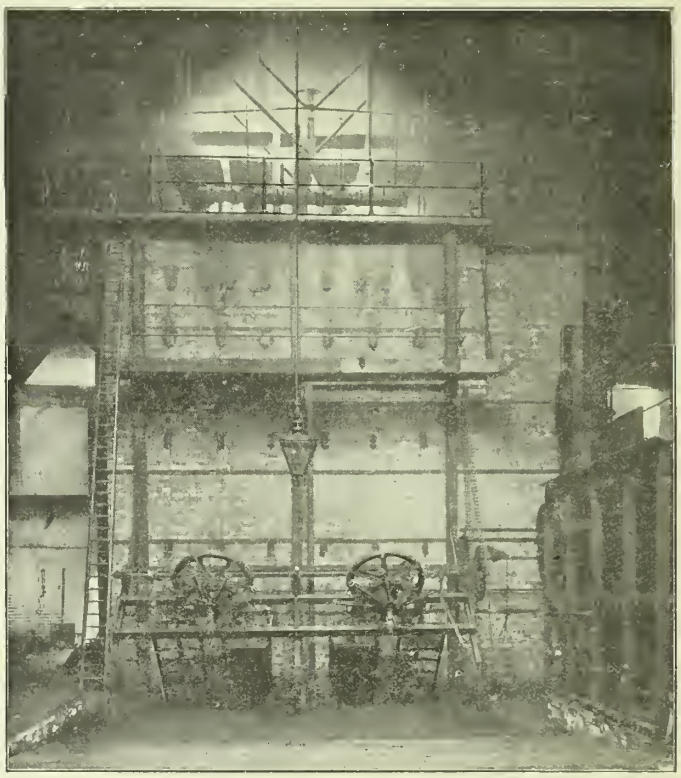
Re-assembling in the afternoon, Sig. Rebuffel described, in considerable detail, various kinds of prepayment meters, which had mechanical devices supposed to prevent fraudulent practices on the part of consumers and others. He showed how, by abstracting the water, gas could be obtained without its being registered; and he further explained a particular system of his own. Sig. Chamon answered many of the criticisms that had been brought against gas-meters.

This concluded the technical business of the Conference.

It was then resolved, as already stated, to hold next year's meeting in Venice, and the year following at Naples. It was also decided that our Italian contemporary "Il Gaz" (under the able editorship of Sig. Cap. Vittorio Calzavara) should be the official organ of the Society. The last function of all was the annual dinner, at which the President, Sig. Rebuffel, suitably expressed the acknowledgments of the Society to various persons, and especially the officials of Bologna. In conclusion, it must be said that, as usual, the whole of the proceedings, both technical and festive, was marked by extreme cordiality on the part of all. Thus it is that the official title of "*Conferenze Amichevoli*," or friendly conferences, of the Italian Gas Society is so deserved, and their annual meetings thoroughly beneficial and enjoyable.

Wood-Stave Water-Pipe.—In a letter to "Engineering Record," Mr. G. T. Prince, of Denver (Col.), offers some favourable remarks on wood-stave water-pipes, especially in regard to their durability. He says Denver has constructed and maintained for many years pipe of this kind in sizes ranging from 20 inches to 48 inches in diameter. There is still in use a 48-inch stave pipe constructed in 1884, a large portion of which is in good condition. The Denver Union Water Company have in service upwards of 75 miles of wood pipe, and are expecting to construct nearly 20 miles more during the coming season; and Mr. Prince remarks that had it not been found, through many years of experience, that this class of pipe is desirable, the Company would not be expending $500,000 this year in the construction of more of it.

THE WOODALL-DUCKHAM VERTICAL RETORTS AT NINE ELMS.



The Woodall-Duckham (Continuously Carbonizing) Vertical Retorts at the Nine Elms Works of the Gaslight and Coke Company.

[The light in the retort-house did not permit of a clear view of the settings being secured. But here for the first time we are able to publish a photograph, showing the exterior mechanism of the conveying plant running under the retorts. A photograph of the top equipment was given on June 4 (p. 638) when describing the Bournemouth installation.]

The programme for the recent conference of the Institution of Civil Engineers included a visit to the Nine Elms works of the Gaslight and Coke Company. This took place on Thursday afternoon, June 20, when about 40 engineers availed themselves of the opportunity of visiting the works. Mr. T. Goulden, the Chief Engineer of the Company, showed the visitors over the station. The installation of Woodall-Duckham vertical retorts were first inspected. These consist of two settings, each of four retorts, with one generator for heating both settings. In all details, they are the same as the installation at Bournemouth, which was fully described recently in the "Journal" (June 4, p. 638). The retorts had only been set to work a few days previously; but they were running continuously, and in a satisfactory manner. The engineers were much struck with the continuous and even working, and also with the quality of the coke, which much resembled oven coke. On leaving the vertical retorts, the new installation of inclined retorts and the hydraulic cranes on the wharf were visited. The party were afterwards entertained at tea by the Company; and a hearty vote of vote was passed by those present both to the Company and Mr. Goulden for their kindness in permitting them to visit the works, and for the facilities afforded. Among the engineers present were Sir George Livesey, Mr. Henry Woodall, Mr. Botley, and Mr. Price.

Gas Engineering at the Leeds University.

At a recent meeting of the Court of the University of Leeds, under the presidency of the Pro-Chancellor (Mr. A. G. Lupton), Professor Smithells announced that the Institution of Gas Engineers had decided to establish a fellowship of the value of £100 a year in connection with the University; and he moved certain modifications in the ordinance relating to the degree of Bachelor of Science, and they were adopted. "Gas Engineering" and "Fuel and Metallurgy" have now been added after "Mining Engineering" as principal subjects in which the degree, with honours, will be awarded. We hope to be able shortly to give full particulars of the course in "Gas Engineering;" Professor Bone, who is at the head of the Fuel and Metallurgy Department, and his colleague in Mining (Professor Thompson) being now busily engaged in getting out their joint prospectus. When it is ready, they hope to meet with a prompt response in the way of students. Meanwhile, we learn that the new buildings are practically finished, and active steps are being taken for their equipment. This is expected to be completed next month or in September, and the installation to be in full operation by October.

REPORTS OF THE COMMISSIONS APPOINTED BY THE GERMAN GAS ASSOCIATION.

ELECTROLYSIS COMMISSION.

The report of the Electrolysis Commission presented to the Mannheim meeting of the German Gas Association contains an account, firstly, of the electrical conditions obtaining in certain other towns over and above those referred to last year,* and also of the phenomena in a town provided with gas and water supplies but having no electrical tram-lines, or at least no tram-lines with uninsulated conductors; secondly, of a further examination of the experimental methods which were described in Dr. Haber's report on the former occasion.†

Electro-Physical Measurements.

The electro-physical measurements quoted below were obtained by Herr Besig in the same manner as already outlined. The first town mentioned is Solingen, one of the places which informed the Commission three years ago that nothing was known about corrosion of the gas and water pipes. Eighteen months since, however, some of the tram-lines had to be renewed, and destruction of the mains became evident. The phenomena in Solingen are peculiar, inasmuch as the stray currents from the tram-lines have done harm over a large district, even to a distance of 2½ miles. Solingen contains two tramway systems, each possessing its own generating station; the two stations being quite close together in a part of the town where the different lines join. Current is only taken from the lines in the immediate neighbourhood of the generating stations; other special return conductors not being employed. Roughly south of Solingen is a suburb named Höhscheid, to which trams run; while west of the town, at a distance of some two miles from Höhscheid, is another suburb named Ohligs, served by trams from the common centre along a totally different route.

The trams run later at night to Ohligs than they do to Höhscheid. Experiments carried out at the latter place during the interval between the cessation of the service there and the cessation of the Ohligs service, have shown that the water-main leading from Solingen to Höhscheid receives return current across country from Ohligs, and that the water-main is raised by the stray currents from Ohligs to a higher potential than that to which the tram-lines near the pipe are brought by the actual passage of trams along them. This is explained by the fact that the line from the generating station to Ohligs is 4½ miles long, exhibits a high resistance, and is not provided with a proper return conductor. Thus much of the current escapes from the rails, passing into the earth and becoming evident even at so great a distance as 2½ miles away. Hence, as a rule, the water and gas mains in Höhscheid are positive in respect of the rails, whereas it would be expected that they should be negative. The chief danger zone is naturally in the neighbourhood of the generating stations, where the average P.D. from the mains to the rails is 2·5 volts, and the maximum P.D. 4 volts. In this part of the town many gas and water pipes have been uncovered, and are shown to be seriously corroded.

The second place where measurements have been carried out is St. Gallen, in Switzerland, which is noteworthy, because it is the only town yet examined where the positive pole of the dynamo was at the time of the investigation connected with the rails of the tram service. It will be remembered that the first paragraph of the rules drawn up by the Electrolysis Commission for the avoidance of electrolytic corrosion states that the negative pole should be connected with the rails; the object being to limit the danger zone to a small area just round the taking-off points, so that the condition of the mains can be easily watched over. The experiments carried out at St. Gallen have brought to light the defects introduced by the opposite method of construction; for over by far the greatest portion of the district served by the trams the pipes were electro-positive towards the rails. The track at St. Gallen consists mainly of one line 5 miles long, which was supplied with current from a cable 330 yards long at a point 2 miles from one end. A second very short cable passed from the generating station to a little branch line which is arranged as a loop. As these two cables were not balanced, the second carried nearly all the outward current—*i.e.*, even a great part of that which actuated the main line. Hence P.D's. of considerable magnitude were found to exist between the two points where the rails were fed with current, although the spots in question were close together. The mean P.D. between the two feeding points was found to be 3·5 volts, and the maximum 5 volts. The average P.D. in those districts of the town where the pipes were positive towards the rails was 2 volts—5 volts being the maximum; but near the generating station, where the pipes were negative in respect of the rails, the corresponding figures were 2·5 and 4·2 volts. The P.D. from the extreme end of the track to the generating station was, on an average, 8·1 volts.

It should be added that a considerable amount of interest was displayed by the local authorities in the experiments conducted by the Electrolysis Commission. A few weeks after the work was completed, the polarity of the tram current was changed over; and in order to balance the two cables (which thereby became return conductors), a temporary resistance was placed in the shorter. A request was afterwards sent to the Commission that the new conditions should be examined, more particularly with the object of ascertaining whether a third return conductor should be installed to take the current away from the 3 miles of track at the end of the longer tramway route. When Herr Besig repcated his visit last December, he found that even the small alterations that had been made had effected considerable improvements. In the places near the generating station where the pipes had originally been negative towards the rails, they were now positive; the average P.D. being 0·7 volt, with 1·3 volts as a maximum.

In February last, a preliminary examination was made of the conditions prevailing in Cassel—a town having a very lengthy tram service, in which the current passes back through the rails to two positions about 300 yards away from the generating station, where it enters proper insulated leads. Although the Managers of the Municipal Gas-Works were not aware of any destruction of their pipes, it was found that several of the mains crossing the rails in the immediate neighbourhood of one of the taking-off points were corroded. One gas-main in particular was very severely injured; being completely eaten away in a certain spot to such an extent that the gas escaped violently directly the clay soil round it was loosened. The general conditions in Cassel bear out the assertion already made by the Electrolysis Commission—viz., that the fact that no evidence of injury done to the gas and water mains has yet come to the knowledge of their proprietors is no proof that such injury has not already been done.

Electro-Chemical Experiments.

During the past year, numerous electro-chemical experiments have been carried out by Herr Besig, with the assistance of Dr. Liese, under the supervision of Dr. Bunte and Herr Reichard; the object of the investigations being to gain further experience with the non-polarizable test-electrode devised by Dr. Haber, and to compare the figures given by the earth amperemeter and the earth coulometer with the actual conditions that obtain in the spots under examination. First of all, some laboratory tests were carried out in Karlsruhe; boxes being filled with soil in the manner already described, and currents of known strength being sent through them between two plates of iron arranged symmetrically on opposite sides. It was found that the operation of filling the boxes required great care and practice, for if they were rammed too tightly the results were too high, and *vice versâ*. But when sufficient care was taken in preparing the pastes and in filling the boxes, the results of the experiments agreed well with the phenomena actually observed in the ground. Naturally the difficulty of imitating the conditions in the ground within the experimental boxes is increased owing to the fact that the earth itself often varies in composition, and that the pipes which act as conductors for the current vary in size, distance, and position with respect to the rails. Nevertheless, at the places in Karlsruhe where experiments were made, the laboratory results were satisfactory; the figures obtained for the current densities agreeing fairly well with the figures calculated from the P.D's. and the resistivity of the earth.

In one of the worst spots in Karlsruhe where the pipes cross the tram-lines, the mean current density close to the pipe was as high as 1 milliampere per square decimetre [9·3 milliamperes per square foot] while the P.D. between the pipe and the earth was on an average 4·5 volts. On exposing the pipe, its surface was found to be almost uniformly corroded, and the earth surrounding it was stained all over with considerable quantities of oxide. In certain places the pipe was eaten into holes several millimetres deep and large enough to hold a finger; the residual metal being sufficiently soft to be cut with a knife. The authorities of the Karlsruhe gas and water supplies, also those of the tram system, have agreed that the state of the gas and water mains has become intolerable. After measurements had been made in other places where the P.D's. were much smaller than those mentioned, and had shown that numerous pipes were already seriously corroded on the surface, it was decided that comprehensive means should be taken to improve the return conductors for the tram current.

Measurements of the electrical phenomena prevailing in the City of Strasburg were first made at the end of 1904. Shortly after they were brought to a conclusion, an opportunity arose for uncovering a pipe for a distance of about 150 yards. The pipe was found to be so seriously corroded that the Commission were requested to make a fresh examination, when a somewhat obscure state of affairs was brought to light. Electro-physical measurements proved that at the place in question the pipe was not being exposed to severe injury by current escaping directly from the rails, for the average P.D. between them varied only a trifle on either side of zero. Nevertheless the fact that the pipe was corroded mainly on that part of its surface which was nearest to the rails seemed to show that stray currents must have led to the injury; the true cause being either a current travelling at right angles to the axis of the pipe although not passing from the pipe to the rails, or (less probably) some condition which had improved before the time when the measurements were made. The former suggestion has seemed more likely because the River Ill flows close to the injured pipe, and it is quite possible that current may have left the latter for the river or for the ground water. It is however, conceivable that the destruction of the pipe may have

* See "Journal," Vol. XCV., p. 164. † *Ibid.*, p. 578.

been due to some purely chemical action—the soil in the neighbourhood containing a good deal of decomposing matter. On the other hand, analysis of the soil and estimation of the carbon dioxide in it have not borne out this supposition.

A third series of measurements, made last October, led to no definite conclusions on the subject; and the investigation could not be pursued further owing to the fact that the street had been in the meantime laid with asphalt, which had doubtless affected all the conditions. Further measurements have also been carried out in other parts of Strasburg, in places where it seemed probable that corrosion of the pipes might have taken place. Where the conditions were favourable, trustworthy figures were obtained without much difficulty. In particular, at the spot where the return conductor nearest to the tram current generating station was connected with the rails, the current density in the immediate neighbourhood of the pipes was as high as 0·5 milliampere per square decimetre; while the pipes were a trifle more than 1 volt positive in respect of the rails. The earth was found to exhibit much higher conducting power than the soil in Karlsruhe; and at this spot it was ascertained that the pipe was seriously eorroded immediately underneath the rail. It was also noticed that the earth current fell to half its original value when a resistance was inserted in the short return lead; the P.D. between the different taking-off points being thereby greatly diminished. In other parts of the city where the soil was somewhat heterogeneous, and especially where the ground water lay as high as the pipes, electro-chemical measurements failed. The ground water apparently withdraws the return current from the pipes, and it is quite possible that the action of the water alters the conditions prevailing from time to time; and it is also possible that the operation of uncovering the pipes for the purpose of making measurements affects the stray currents to a more than usual extent. It would seem, too, that there may be considerable difficulty in using the wooden amperemeter satisfactorily in such very wet earth; so that this instrument, and also the coulometer, may require modification, especially in regard to their insulation. This point has been referred to Dr. Haber, who has accepted the invitation extended to him to join the Commission.

The Final Report.

Ever since the Commission was first constituted in 1897, exhaustive reports on the conditions found in every town investigated have been prepared, which have been submitted to the President of the Association, and also to the authorities of the towns in question. It has now been decided to draft a general report of all the work done by the Commission, and to publish the result in a pamphlet accompanied by plans of the different towns drawn to uniform scale. This work has already been begun; but it was unfortunately found impossible to have the final report ready in time for submission to the Mannheim meeting of the Association.

Future Investigations.

A joint meeting of the Commission, the German Association of Industrial Electricians, and the Association of Tram and Light Railway Proprietors, was held last December at Halle—the then President of the former Electrical Society, Dr. Kohlrausch, in the chair. At the meeting a debate took place regarding the best method for the future investigation of the electrolysis question. Subject to the approval of the respeetive Associations, it was decided to create a Joint Commission composed of four members from the Gas Association, and two members from each of the Electrical Societies, with full power to deal with the whole matter; while the latter bodies decided to appoint an Engineer to collaborate with Herr Besig in the actual work. The Gas Association agreed to the proposal, nominating as members of the Joint Commission Herr Nolte, Professor Bunte, Herr Kordt, and Herr W. H. Lindley, with Dr. Haber and Herr Lampelius as additional members in case of emergency. The Electrical Associations, on their part, selected Herr Otto, Dr. Michalke, Dr. Haas, and Herr Cremer—appointing Herr Buschbaum to act in conjunction with Herr Besig. A meeting of the "Joint Electrolysis Commission" thus constituted was held last Mareh in Berlin; Herr Lindley being elected as President, and Herr Otto as Vice-President. The programme of the work to be undertaken during the year commencing with April, 1907, was drawn up at the meeting. It included investigations in the towns of Brunswick, Frankfort-on-Main, and Nuremberg, to be followed by experiments in Cassel, Wiesbaden, and Düsseldorf. The experiments at Nuremberg promise to be peculiarly interesting, because the tram service there is arranged on the three-conductor system; the rails being employed as the neutral lead. As soon as sufficient material is in the possession of the Commission, the new code of rules will be discussed and drawn up; Sub-Committees being appointed to deal with matters of detail.

GAS-METER COMMISSION.

Fabric Diaphragms for Dry Meters.

The greater part of the report presented by the Gas-Meter Commission this year is taken up with a further investigation of fabric diaphragms for dry meters, with special reference to the examination and general behaviour of such diaphragms as are manufactured by the firm of Elster and Co., of Mayence. The general method of preparing such diaphragms from plain or twilled calico, and the gradual conversion of the linseed oil into an insoluble body when exposed to the atmosphere, were fully described in last year's report.* The manner in which linseed oil dries when exposed to the air on glass plates is already thoroughly well known; but experiments do not seem to have been carried out upon its drying when the oil is absorbed within the pores of a fabric. For this reason, special experiments (dealt with below) have been instituted into the behaviour of new fabric diaphragms; while the method of testing old diaphragms for the proportion of insoluble "linoxyn" in them has been elaborated by the late Dr. Homann and Dr. Fischer, as follows.

Methods of Examining Fabric Diaphragms.

The scheme proposed by the Commission for the examination of calico diaphragms impregnated with linseed oil, is divided into two parts; the first part describing the method for estimating the proportion of incompletely oxidized linseed oil (*i.e.*, of the constituents soluble in ether or carbon tetrachloride), and the second part describing the estimation of the so-called linoxyn (that is, the proportion of matter which has become insoluble). For the former purpose a piece of the membrane 50 c.m. long and 6 c.m. wide (roughly 20 inches by 2 inches), weighing 8 to 9 grammes, is weighed without any previous drying. A dry flask holding 250 c.c. is weighed and connected to a 100 c.c. soxhlet apparatus by means of a sound cork. The strip of fabric is loosely rolled up, introduced into the soxhlet, and a proper quantity of solvent (either common ether or carbon tetrachloride) is added. This quantity should be from 20 to 30 c.c. more than is necessary to enable the soxhlet to syphon properly. The apparatus is then fitted with a reflux condenser, and heated over a water-bath if ether is employed, or on a sheet of asbestos over a naked flame if carbon tetrachloride is used, at such speed that the soxhlet fills and empties itself about ten times per hour. At the end of six hours the extraction is stopped; the bulk of the solvent is distilled out of the flask; and the residue is evaporated on the water-bath. The flask is then dried for an hour at 100° C.; allowed to cool thoroughly; and lastly weighed. By deducting the net weight of the flask, the weight of matter soluble in ether is obtained.

For the estimation of the linoxyn, 400 c.c. of a solution containing 20 grammes of anhydrous sodium carbonate per litre are put into a beaker and raised to the boiling point. The strip of fabric removed from the soxhlet apparatus is dropped into the liquid, stirred up frequently with a glass rod, and allowed to boil for half-an-hour; the water that evaporates being replaced by hot liquid, so as to maintain the concentration of the solution. If necessary, the solution may be renewed. The extracted fabric is then washed until it is no longer alkaline—preferably by manipulating it under a tap; and it is then thoroughly dried in the air and weighed. This last weight represents the amount of true fabric in the prepared diaphragm. By subtracting this weight from the original weight of the strip, the quantity of impregnating material is obtained; and by deducting from the latter the proportion of soluble matter, the amount of insoluble linoxyn is left. It should be remarked that the foregoing process is only suitable for the examination of a membrane prepared with pure linseed oil, and would require modification if applied to any material made from a resin varnish. However, as mentioned in the last report, true varnishes have not been satisfactorily employed in constructing the diaphragms of dry meters, and a scheme for their examination is, therefore, not required.

The Oxidation of Absorbed Linseed Oil.

A large quantity of cotton fabric prepared by Messrs. Elster and Co. for use in dry gas-meters, and impregnated by them with linseed oil during January, 1906, was handed to the Government Stamping Department and to the authorities at the Karlsruhe and Munich Gas-Works for examination. The samples were freely exposed to the air and were tested on the same days month by month for 5 months, then put aside for 4 months, and tested once more, and finally tested 12 months after preparation. Both ether and carbon tetrachloride were employed as solvents, the proportion of insoluble matter obtained with each liquid at the three different laboratories and at the dates mentioned being recorded in the following table, where the columns marked A indicate the results obtained with carbon tetrachloride, and those marked B the results obtained with anhydrous ether as solvent:—

Proportion of Total Impregnating Material Insoluble.

Date of Test.	Tested by the Stamping Commission.		Tested at the Munich Gas-Works.		Tested at the Karlsruhe Gas-Works.	
	A	B	A	B	A	B
February, 1906 .	66·9	—	67·2	69·6	—	73·3
March ,, .	68·2	—	70·7	73·4	69·8	73·5
April ,, .	71·7	74·7	73·7	75·3	71·6	74·4
May ,, .	73·5	75·4	—	—	76·4	76·8
June ,, .	74·9	76·1	75·6	77·3	76·5	76·9
October ,, .	76·8	77·5	78·9	79·9	77·0	77·9
January, 1907 .	77·5	79·6	77·9	80·1	—	—

On inspecting the figures, it will be seen that the proportion of oil still remaining in a soluble condition was greater when using carbon tetrachloride than when using ether. This difference is perhaps to be explained by the higher temperature during extrac-

* See "Journal," Vol. XCV., p. 232.

tion. As carbon tetrachloride boils at 78° C., the temperature in the soxhlet is about 75° C.; whereas when ether is employed the corresponding figure is only about 30° C. The difference, however, is of no importance, because the actual purpose of the investigation is merely to elucidate the manner in which the linseed oil oxidizes. It will also be observed that the figures given from the three different laboratories vary somewhat; the main cause doubtless being that it was impossible to spread the oil over the whole surface of the fabric with perfect uniformity. In consequence, the thinner layers of oil dried more rapidly than did the thick ones. It is, of course, not to be expected that the linseed oil should become wholly insoluble, because it contains saturated fatty acids, which do not absorb oxygen. The presence of such unoxidized fatty acids is necessary, or the membrane would not retain the requisite suppleness. On an average, it may be said that not more than 80 per cent. of the linseed oil spread upon the fabric will become insoluble.

The Tightness of Oiled Diaphragms.

Experiments have been carried out by the Government Stamping Department, in an apparatus designed by the late Dr. Homann, upon the impermeability to gas of diaphragms impregnated with linseed oil. This apparatus consists of a massive cylinder of brass, fitted underneath with an inlet and outlet for gas, and a tube communicating with a pressure gauge, reading on an enlarged scale. The tube of the cylinder is closed with a collar holding in place a piece of the membrane under examination. Tests with this apparatus have shown that for all practical purposes fabrics treated with linseed oil are perfectly gas tight. In one experiment when the soluble portion of the oil was extracted from a new diaphragm, or one two months old, in a soxhlet with carbon tetrachloride, the diaphragm became leaky, and the pressure of the gas sank from 15·7-10ths to 7·9-10ths in 10 seconds. On the other hand, when a piece of the same membrane two months old was extracted with ether, the pressure of the gas only fell from 15·7-10ths to 15·35-10ths in 20 minutes; so that it may still have been regarded as almost completely gas tight. Further experiments are required to show whether the membrane may remain almost completely tight to gas even when the soluble portion of the oil has been washed away.

Dr. Schumann, the Chemist at the Munich Gas-Works, divided the membrane sent him into two portions; leaving one half freely exposed to air and wrapping the other up in paper. When the one sample was extracted with ordinary ether one month after being so wrapped up, the proportion of insoluble matter was only 70·5 per cent., having increased very little from the amount shown in the first column of the preceding table. On the same date, a sample of the membrane exposed to air gave 73·45 per cent. of linoxyn when extracted with ordinary ether, 73·95 per cent. when extracted with absolute ether, and 70·75 per cent. when extracted with carbon tetrachloride. Dr. Schumann has also suggested that the oxidation of the linseed oil on the diaphragms might be hastened by exposing them to a current of air or to heat in the same manner as is adopted in the preparation of so-called lithographic varnish; but the Commission do not know whether any experiments in this direction have been carried out.

The Government Stamping Department, however, have tried placing a loosely rolled strip of membrane in a glass vessel closed with a cork, provided with an inlet for air passing almost to the bottom, an outlet leading to a water pump, and a thermometer. On putting the apparatus in an air-bath, heating it to between 70° and 80° C., and aspirating through it a slow current of air dried by means of sulphuric acid, a strip of membrane so treated for 48 hours contained 77·89 per cent. of linoxyn; whereas another strip freely exposed to the atmosphere only contained 75·4 per cent. Very similar experiments carried out by Dr. Fischer on twilled calico freshly treated with raw linseed oil several times and allowed to dry, showed that, after exposure in a similar apparatus for 36 hours, the samples contained 79·8 per cent. of their linseed oil in an insoluble condition when extracted with ether; whereas only 56·9 per cent. of the oil was rendered insoluble when the strips were left hanging up in frames in the laboratory. The membranes artificially oxidized in this manner proved to be perfectly gas tight for all practical purposes. Presumably, if the process were modified in a few respects it might be available on the large scale; but oxidation in a current of oxygen as has been suggested would probably prove too expensive.

Experiments have been instituted by the Government Stamping Department to compare the behaviour of membranes heavily coated with linseed oil with such as bear a smaller quantity. One sample which had been prepared in the laboratory by impregnating linen with pure linseed oil, contained at the time of the test 61 per cent. of its coating in an insoluble form; the other was a specimen of the Mayence material, and contained between 79 and 80 per cent. of linoxyn. Samples of each, 15 c.m. long by 5 c.m. wide, were weighed in tubes on a chemical balance, and were then exposed for three days to a current of coal gas passed through a wash-bottle containing benzol in order to load it with the vapour. At the end of the experiments the strips were weighed as before; but no appreciable difference was noticed in the figures. On inspection, however, the new strip had lost its polished appearance, and felt more sticky than the old one. A second experiment was carried out in a similar fashion for 8 days, using gas without adding benzol vapour. The weights only altered a trifle; but once again the new strip had lost its polish.

It was mentioned in the 1905 report that Messrs. Elster and Co. had prepared numerous fabric diaphragms in the year 1891, and also others so far back as 1884 and 1882. Dr. Fischer has recently taken the opportunity of examining one of these diaphragms dating from 1882. He found the fabric to be pure cotton, but heavier and more closely woven than the material employed to-day. The impregnating liquid had been a raw vegetable drying oil, or such an oil boiled without siccatives. In view of the age of the diaphragm, it was not possible to ascertain chemically whether the oil was actually linseed; but in all probability that was the case, as no other oil dries so well. In certain places the diaphragm contained a small quantity of iron compounds, which presumably came from rust spots round the rivets that held it in place in the meter. When a piece of the membrane free from rust was examined in the Homann apparatus already described, it proved to be perfectly gas tight; for a pressure of 15-10ths did not fall appreciably in a quarter-of-an-hour. On examining it by the process previously given, the proportion of coating material insoluble in ether was found to be 77·3 per cent.

General Remarks on Fabric Diaphragms.

In attempting to pass a judgment upon the general utility of diaphragms made by treating fabrics with linseed oil for employment with dry gas-meters, it is necessary to remember that the methods of making such diaphragms and of testing them have only been gradually elaborated. It is now established that the gas-meter factory at Mayence took much care in making the diaphragms when they began to use them in place of leather; but a few failures cropped up, doubtless owing to a lack of knowledge as to the durability of the oil fabrics employed. The failures may be explained by the circumstance that at the date in question no method was available for ascertaining immediately the diaphragms were finished how they would behave when exposed to gas for long periods of time. Recent experiments have shown what is the best fabric to treat with oil, and also that pure linseed oil is the only liquid fit for use. The experiments have also demonstrated that not more than 79 to 80 per cent. of the linseed oil applied to the fabric ever becomes insoluble.

Although numerous gas-works have found that these fabric diaphragms behave satisfactorily, it cannot be denied that unfavourable results have been obtained elsewhere, and that they have therefore obtained a certain measure of unpopularity. The fabric diaphragms began to lose favour in 1902—about the time when cold carburation was adopted in many factories; and the feeling of distrust spread, although it was not wholly justifiable. Shortly afterwards the Rhenish-Westphalian Branch of the German Gas Association sent round to its members a set of questions relating to the failures that had occurred during the use of wet and dry meters, and asking them for information as to the actual or probable causes. The results tended to show that where the gas was excessively carburetted, it acted more or less prejudicially on dry meters fitted with non-leather diaphragms; but the answers to the questions that were propounded caused these dry meters to appear in a less favourable light than they should, because due allowance was not made in collating the replies for the fact that the overwhelming majority of the meters referred to had leather diaphragms. As a matter of fact, among the 159 gas-works applied to, only between 7 and 12 per cent. were using meters with fabric diaphragms—simply because at the time in question most gas engineers doubted whether such diaphragms were trustworthy, and had therefore not adopted them on a large scale.

On the other hand, it must not be forgotten that leather itself is not of necessity a material which retains its desirable properties indefinitely when exposed to a stream of gas. It is, of course, the best natural material to use; but every meter maker has adopted his own rules for selecting the variety of leather he employs, and his own method of preparing it. Leather is gradually rising in price; its applications increase in number; its supply depends on numerous conditions which are not altogether under control; and for many purposes no substitute can be discovered for it. Therefore, in the opinion of the Commission, it would seem desirable not to abandon the use of oiled fabric diaphragms, but to utilize the experiments that have been carried out, and published, in the production of something better than has hitherto been manufactured. Further investigations are undoubtedly called for in order to ascertain how long a fabric diaphragm containing 79 or 80 per cent. of its oil in an insoluble condition will resist the action of different kinds of coal gas. For this reason Dr. Fischer's test of a diaphragm 20 years old was quoted above. It must not be imagined that the diaphragm tested by him was something peculiar; for at the time many meters were being supplied to the trade fitted with fabric diaphragms. Experiments instituted with the object of determining how long a non-leather diaphragm will remain serviceable consume much time; but that is no reason why they should not be carried out. Perhaps the experimental laboratory of the Association will undertake such a research.

The report of the Meter Commission is brought to a conclusion by a brief reference to the question of re-stamping meters in Germany—on which subject there is nothing further to add to what was stated last year. A short notice follows of other private work done by the members during the period under review.

The King has granted a Charter of Incorporation to the Society of Chemical Industry, founded in 1881 to promote the application of chemical science to arts and manufactures.

MECHANICAL STOKER AT THE GENNEVILLIERS (PARIS) GAS=WORKS.

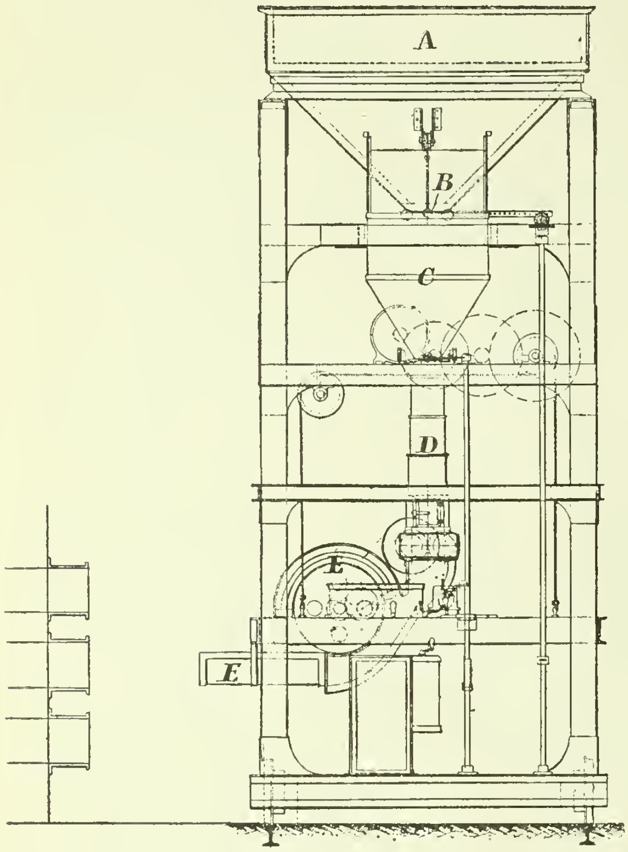


Fig. 1.

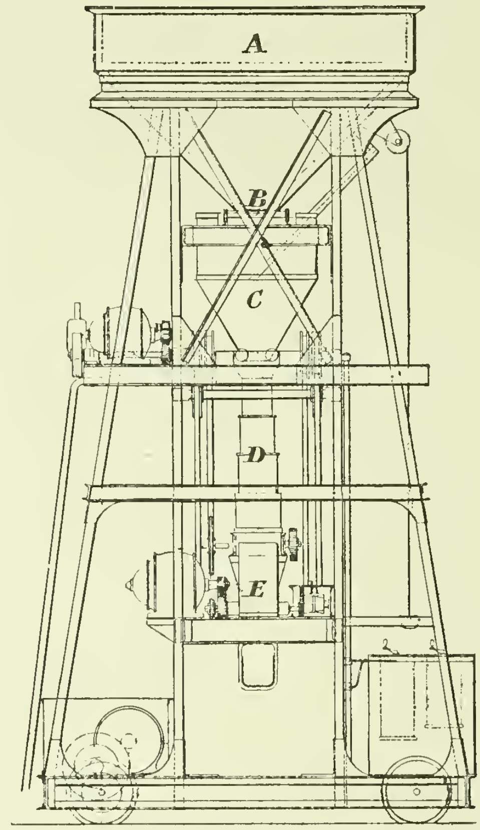


Fig. 2.

At the recent Congress of the Société Technique, M. Cabrier described a mechanical stoker which is now in operation at the Gennevilliers works of the Company supplying the suburbs of Paris with gas. Its principle had been brought under the notice of the members at the preceding congress;* but it was thought that an example of its practical application in gas-works would be interesting.

Fig. 1 is a side view of the machine, showing its position in relation to the retort-bench; fig. 2 is an elevation; and fig. 3 shows cross sections of the distributor—the mechanism by which the coal is projected into the retort. A is a hopper capable of holding from 4 to 4½ metric tous of coal. At its lower part, the hopper is closed by a door B, worked by a lever within reach of the attendant. Below the hopper A is a smaller one C, the maximum capacity of which is about 10 cwt. It is furnished with a regulating plate, by which the charges can be varied in weight from 8 cwt. to 9¾ cwt. This plate is moved by a chain operated from the attendant's platform. The machine is mounted on a framework to which an upward or downward motion is given by means of a winch placed at the top, and driving belt pulleys by the aid of an electric motor. Above the charger E is the distributor and a telescope pipe D connecting it with the lower part of the measuring hopper C. The machine is moved along the fronts of the retorts by electric motors, and every motion is controlled by appliances within easy reach of the attendant.

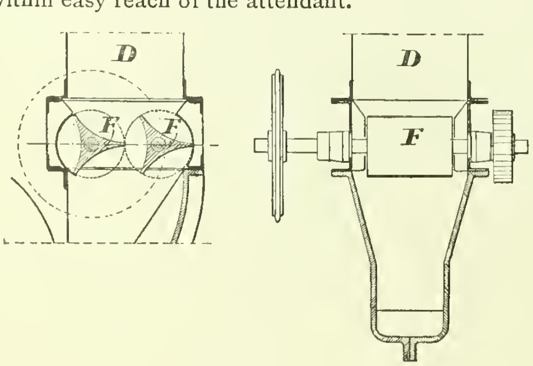


Fig. 3.

The charger consists essentially of a wheel carrying four vanes F (fig. 3), revolving in a cast-iron trough, the bottom of which is not concentric with the vanes—an arrangement which enables a perfectly straight stream of coal to be thrown. On reaching the tangential point, the vane has entirely left the coal, which continues to glide onwards by its own velocity into the channel of the charger. There is sufficient play between the vaues to allow of the passage of the largest pieces of coal; so that there is no danger of the distributor becoming blocked up. The troughs of the distributor are filled in the ordinary way; and the author stated that, whatever the condition of the coal—dry or wet—it always flowed at the same rate. In order to be in a position to charge with moist coal, the measuring hopper C is fitted with a door large enough to allow the passage of even very wet coal in a short space of time. The coal fills the telescope pipe D, and reaches the distributor, by which it is couveyed to the charger.

The machine is completed by an automatic speed reducer. All the electric motors employed are "series," with the exception of the one connected with the charger, which is a "shunt" motor.

* See "JOURNAL," Vol. XCIV., p. 926.

DE BROUWER INSTALLATIONS IN FRANCE.

One of the papers at the Congress of the Société Technique was by M. Lacaze, the Manager of the Cie. Continentale pour la Fabrication des Compteurs, &c., of Paris, who are manufacturers in France of the De Brouwer type of coke-conveyors and stoking machines. M. Lacaze gave a list of the various plants put up; and, as it may prove of use for reference purposes, we give the following summary of his paper.

It was on Dec. 7, 1895, that M. De Brouwer took out his first patent in France for a hot-coke conveyor to do away with the hard and primitive labour of dragging away and quenching hot coke. It is a mistake to suppose that such mechanical methods are only applicable to large gas-works. M. Deschamps, of Albert-sur-Somme, adopted the conveyor for a bench of three beds, of which only two were at work. He reported in 1899 that the plant effected a yearly saving in labour for coke-breaking of about 1400 frs. (£56), and that this would be increased by another 480 frs. (£19) when an elevator and screen were fixed. The first installation in France, however, was at Fontainebleau, in 1897, put up under the responsibility and guarantees of the contractors. It comprised two conveyors, which delivered the coke on to a third one, at right angles to them, and which carried the material to the sorting screens. The trough of the conveyors was 120 mm. (4¾ inch) deep by 640 mm. (25¼ inches) wide; the bottom being formed of a plate 800 mm. (31½ inches) wide by 10 mm. (⅜ inch) thick, with renewable pieces of flat iron. The chain links were 100 mm. (4 inches) centre to centre, and at every seventh link was a cross round bar, 6·4 mm. (¼ inch) diameter.

The next plant put up was at Rouen, in 1898. The 100 mm. (4-inch) liuks were replaced by others of 320 mm. (12⅝ inches), and the cross-bars were made flat instead of round. With small links it was fouud that the slightest wear led to considerable stretching of the chain, and the round bars crushed all the pieces of coke which got under them. In the Dijon installation, 1899, a chimney

was adopted for the first time to take away the smoke and steam as the coke was quenched. The coke storage was sufficient to contain a full night's production, and arrangements were made for the direct loading of the railway trucks. At Lyons, in 1900, two plants were erected—one at the Villeurbanne works, and the other at Lyon-Vaise. In both cases, the coke was allowed to fall to the ground from the inclined end of the conveyor, so that it should be drier when sorted later on than if it went direct to the screens after being quenched. At Villeurbanne, the retorts were charged and discharged by the Boutan machines; and at the other works they were inclined retorts built by MM. De Lachomette and Cie. Notwithstanding the almost instantaneous discharge of the whole of the coke from a retort, the conveyor effectively carried away the coke, which trailed over a considerable length of chain.

At Havre, in 1901, was put up the first large coke-tank, holding 1200 hectolitres (42,400 cubic feet). There were four conveyors serving a cross conveyor leading to the first screen. The coke was taken from this by an elevator supplying the hopper. In 1902, at Mouche-Lyon, a conveyor was again adapted to a bench of inclined retorts. Then, in 1903, M. De Brouwer brought out his marvellously simple charging-machine. The same year, it was shown at the Toulon works during the Congress. This led to the installation at Barcelona, and was followed by the introduction, in 1904, of the discharging pusher; thus completing the apparatus for the series of operations. Now a retort 6 metres (nearly 20 feet) long can be charged and emptied as easily as one 3 metres in length, and much heavier charges can be used. Instead of charges of 170 to 180 kilos. (about 3½ cwt.) in a 3-metre retort, a charge of 500 kilos. (nearly 10 cwt.) can be put into a retort 6 metres long. Thus arose the discussion as to the advantages of light and heavy charges. M. Lacaze is of opinion that heavy charges to be carbonized in 6 hours are the best; and some put in 550 to 560 kilos. (11 cwt.) every 8 hours. At Barcelona, the retorts were tapered towards the outlet end, and were 4 metres (13 ft. 1½ in.) long; a pusher (not the De Brouwer) with a single rod was used, as for coke-ovens. It was found that the tapering was not essential, and the mass of coke offered no difficulty.

The first De Brouwer pusher was used in the Toulouse installation, in 1904, which may be considered a complete model of its kind. This pushing-machine had revolving links of cast iron; later on, they were made of steel. Old back-to-back beds of retorts, 3 metres long, were turned into through beds, of 6 metres. In the same year (1904), at Besançon, an old bench was replaced by a new one, and the retort-house roof raised to get in measuring-chambers. At Versailles, an entirely new works was built; but here, as at Toulouse and Besançon, provision was only made for a coal supply for one charge. In the installations at Lille-Vauban and Lyon-Perrache, in 1905, this has been increased to four charges. M. De Brouwer is just now arranging for a coal supply for 96 hours in front of his retorts. At Lille, the coal-hopper is arranged at the end of the bench, with a conveyor running parallel to it from the hopper. At Perrache, there are continuous hoppers. At Lyons, also in 1905, there were put up, in addition to the measuring-chambers, continuous hoppers above them, from which they took their supply. Then when the men got used to the work, the slide between the hopper and the measuring-chamber was done away with, and the charge is no longer measured at all. This is a simplification; and is confirmed by experience at the South Suburban Gas Company's works.*

Subsequent installations were at Bordeaux-Bastide (two benches of seven beds of nines, built by MM. De Lachomette and Cie.) and at Lille-Vauban (for a bench of eight beds of eight retorts arranged in four tiers, built by M. Derval, of Paris). In 1906, in a new plant at Lyon-Perrache, the quenching was effected in a cross conveyor, separate from the conveyor in front of the retorts. Last year, also, retort-house machinery was installed at the Nice and Nancy Gas-Works. Both of these have quite recently been described and illustrated in the "Journal." At the present time, a De Brouwer conveyor is being placed at Nanterre, in front of an inclined-retort bench; and complete new works are being erected at Bacalan-Bordeaux. In Italy, at Naples, retort-house machinery is being adopted for a bench of eight beds; and also the same at the new works for Venice.

In Switzerland, in the year 1898, conveyors to serve nine beds of nine retorts were put up at Winterthur; and again, in 1901, for sixteen beds at Basle and Zurich; in 1899, for seven beds at Geneva; and for eight beds at Berne, in 1901; at Reinthal, in 1902, for three beds of nines; and again at Geneva last year for six beds of nine retorts. The total number of retorts in Switzerland stated to be served by the De Brouwer conveyor is 1175. From these figures and facts, some idea of the mechanical progress made in retort-houses can be realized, and the methods adopted to compensate for losses due to the increased price of coal, and the reduced price of gas consequent upon renewing concessions.

* See "Journal," Vol. XCVII., p. 27.

Onslow's Gas Heating-Burner.—With regard to the reference that was made at the recent Engineering Conference of the Institution of Civil Engineers to the system employed by Mr. A. W. Onslow, the Gas Engineer to the Royal Arsenal at Woolwich, for heating metal, &c., by means of ordinary illuminating gas, it may be pointed out that the burner used was the subject of a patent secured by Mr. Onslow in 1904, a description and an illustration of which appeared in the "Journal" for May 9, 1905, p. 369.

COMBUSTION WITH INVERTED GAS-BURNERS.

Address by Dr. Bunte.

As mentioned in the general report of the proceedings at the recent annual meeting of the German Association of Gas and Water Engineers at Mannheim, which appeared in the "Journal" for the 18th ult. (p. 809), an address was delivered by Dr. H. Bunte, of Carlsruhe, on "The Phenomena of Combustion with Inverted Gas-Burners."

Dr. Bunte explained that in the ordinary bunsen flame about one-half of the air required for the complete combustion of the gas passes through the air-inlets at the bottom of the mixing-tube. The inner lower cone of the flame is formed by the combustion of this air in the gas, and there results the mixture of water vapour and carbonic oxide with hydrogen and carbonic acid (in proportions constituting equilibrium), together with nitrogen. Water-gas and nitrogen pass thence into the outer zone, and there the water-gas is burnt by the fresh supply of air which reaches the outside of the flame. When a mantle is put over this upturned bunsen flame, the water-gas formed in the flame is just inside the mantle, and the secondary supply of air is just outside it. The two meet on the mantle itself; and the resulting combustion of the water-gas raises the mantle to incandescence. Figs. 1 and 2 show the composition of the bunsen flame, and the manner in which it may be split up. The following is the composition of the water-gas mixture in volumes per cent.: Nitrogen, 71·8; hydrogen, 13·3; carbonic oxide, 10; carbonic acid, 4·9.

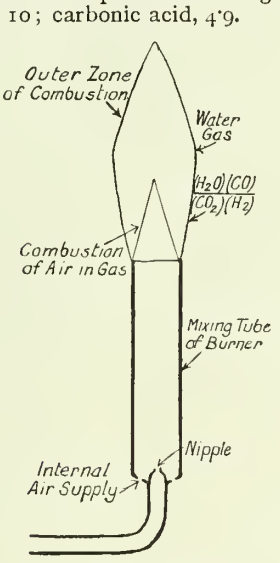


Fig. 1.—Flame of Bunsen Burner.

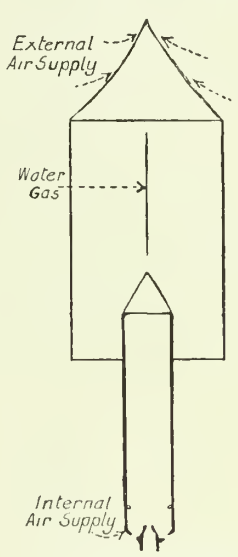


Fig. 2.—Flame of Bunsen Burner Split up.

It was well known, Dr. Bunte remarked, that a slight rise in the temperature effected a relatively very great increase in the light radiated; and it was by taking advantage of this fact that the inventors of high-pressure and intensified gas-burners had secured an enhanced duty. He referred to a drawing of the Lucas intensified gas-lamp, in which the whole supply of air requisite for complete combustion of the gas entered the mixing-tube, and the cones were no longer clearly differentiated, while a certain amount of pre-heating occurred.

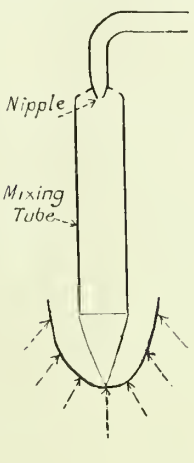


Fig. 3.—Inverted Burner with Hot Mixing Tube.

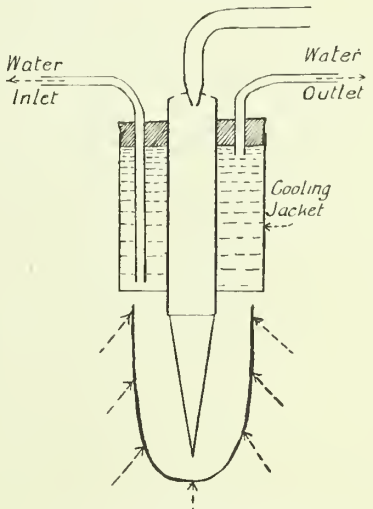


Fig. 4.—Inverted Burner with Cooled Mixing Tube.

Passing on to inverted burners, Dr. Bunte pointed out that, whereas in the ordinary incandescent burner about three volumes of air enter the mixing-tube to one volume of gas, when the burner is inverted the air entering the mixing-tube becomes

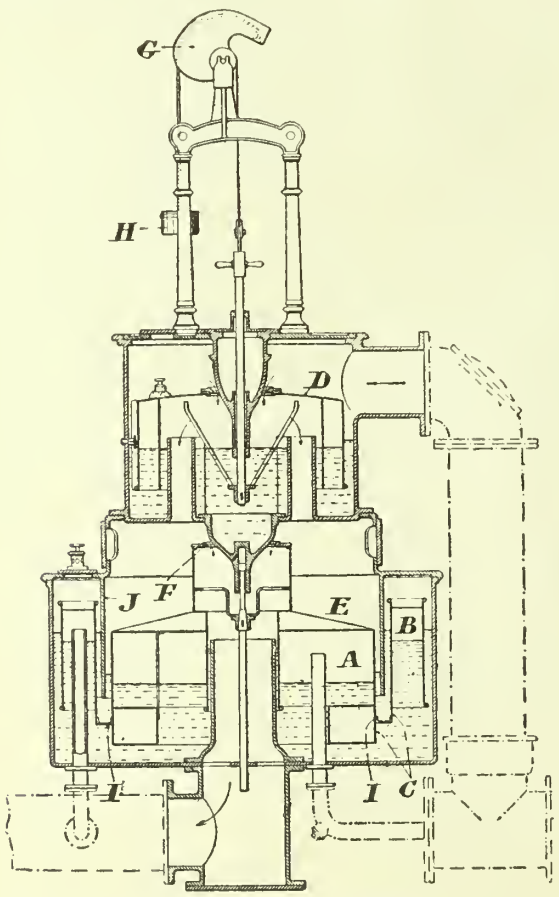
naturally reduced to almost two volumes. The heating of the gas and air which took place when the burner was inverted was, however, advantageous, and quickened combustion. There was the green core of air burning in gas, and outside (but within the mantle) a reservoir of water gas. In the inverted burner, the area of the outer zone was normally smaller, and the temperature became higher. Notwithstanding the preliminary heating of the gas and internal air supply, the inner cone was much contracted, and the outer one reduced in area. But when the mixing-tube was kept cool by means of a jacket with cold water circulating through it, the flame became enlarged, and there was reduction of temperature and loss of intensity of illumination.

The effects alluded to were illustrated by reference to other diagrams. Fig. 3 shows the normal inverted gas-light flame, consuming 105 litres (3·71 cubic feet) of gas per hour, and drawing into the mixing tube 2·32 volumes of air to one volume of gas. He pointed out that the mixing-tube became hot, and that the outer mantle of the flame had an area of 45 square centimetres (nearly 7 square inches). The mean hemispherical intensity of the light was 100 Hefners (91 English candles). Fig. 4 shows the same burner with cooling-jacket attached. It would be seen that the outer mantle of the flame had enlarged to an area of 65 square centimetres (10¼ square inches), and concomitantly the mean hemispherical intensity of the flame dropped to 57·4 Hefners (52·2 English candles).

The investigations on which these conclusions had been based were carried out at the new Experimental Works of the Association at Carlsruhe; and Dr. Bunte appealed to burner-makers to submit their new types of burners for investigation there, in order that the principles governing the action of the burners might be further studied. Many marked advances were, he said, still to be expected in incandescent gas-burners; and the interests of the gas industry would benefit if more attention were devoted to perfecting burners.

AUTOMATIC PRESSURE-REGULATOR.

As briefly mentioned in the notice of the Congress of the Société Technique which appeared in the "JOURNAL" for the 18th ult., a paper was read by M. Heeley (of the Cie. pour la Fabrication des Compteurs, of Paris), in which he described an automatic pressure-regulator brought out by the firm.



An Automatic Pressure Regulator.

He remarked that all gas managers are aware of the practical difficulties met with in maintaining constant pressure at a particular point of the distributing system; as it is impossible to forecast sudden variations in consumption due to the weather or to the simultaneous ignition of a large number of burners. The result is that no pressure-regulating system is complete unless the governor bells are loaded in proportion to requirements; and this is a rather delicate operation, involving constant supervision. Thus the need of a regulator to automatically provide the required pressure has long been felt. The one the author's firm brought before the members ten years ago solved the problem in a very simple manner; but it only gave the desired pressure when the gas was supplied from holders of uniform weight. The principle on which that regulator was constructed has been applied in the instrument shown in the accompanying illustration, but with the addition of certain parts to nullify the effects of initial variation of pressure, and thus prevent it having any effect on the automatic working of the regulator. Hitherto this could not be done without the use of a pressure-unifier placed before the regulators. The instrument also differs from the ordinary governor in this respect—that the bells have regulating seats instead of fixed cones; but the modification does not in any way affect the working.

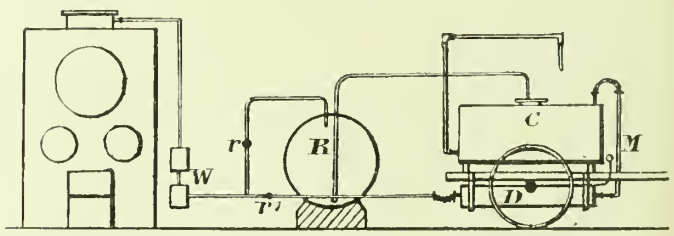
Looking at the general features of the instrument, it will be noticed that the higher part is a reproduction of the old regulator, while the lower part corresponds to the regulating bell C. This is divided by a partition J into two parts, A and B, which are, however, made interdependent, owing to the cross-pieces I, and thus participate in the same movements.

In order to explain the general working, we will take two cases, the instrument being in a state of equilibrium: (1) When the inlet pressure suddenly changes, owing to the displacement of the top lift of a telescopic holder; (2) and when there is an increased output of gas due to the ignition of a large number of burners. In the former case, it is found that this variation acts both above and below the two bells D E. It thus produces equal pressures in opposite directions, which nullify each other, and consequently cannot affect the outlet pressure in any way. In the second case, it is clear that, as in all station governors, there will be a lowering of the outlet pressure, which will impart a descending motion to the two bells. But the only effect of this change of position, as regards the lower bell, is the maintenance of the outlet pressure. This is not so with the upper bell, which, in falling, increases in weight owing to the shortening of the lever arm upon which the weight H acts. The result is that pressure under the upper bell is augmented, and is transmitted through the seat F to the lower bell, to raise the exit pressure to the extent required, which is determined by the form of the cam G and the heaviness of the weight H.

The combination constituted by parts A and B of the bell E may be regarded as an ordinary governor bell loaded in proportion to the output by the action of bell D, which, on account of the variable pressure it determines, acts in the same way as the movable counterweights or charging-tanks employed to alter the weight of non-automatic governor bells in order to obtain the desired pressure.

FILLING TANK-WAGGONS BY COMPRESSED AIR.

Where gas-works are not connected with any railways by sidings, and where the tar and ammoniacal liquor are not sent away in barrels, difficulties frequently arise in the operations of filling and emptying the tank-carts used for the transport of these liquid bye-products. It is not always easy to find railway goods yards where the ground is sufficiently high to allow of the natural rapid flow of the liquor into railway tank-waggons.



M. Sar (of Montpellier) briefly described, at the recent meeting of the Société Technique du Gaz, how he had overcome such difficulties by the use of compressed air. He illustrated his system by the aid of a little sketch herewith reproduced. The first operation consists in the filling of a tank-cart C from the reservoir R. The cock r being opened, and r^1 shut, the Westinghouse air compressor W (of the Paris, Lyons, and Mediterranean Railway type) worked by the adjacent steam-engine forces the air back into the reservoir, and the liquor passes without loss or smell into the tank-cart. When the latter is full, the Westinghouse apparatus is stopped. The second operation is charging the two air reservoirs D, on the tank-cart, with compressed air. This is done by simply opening the cock r^1 and shutting r; so that on starting the Westinghouse compressor, air is forced into the cylinders, until the gauge at M indicates 4½ to 5 atmospheres' pressure. These two operations take 10 minutes; and the tank-cart is then ready to go to the railway. To discharge the liquor into the railway tank-waggon, no matter where it is, the carter merely opens an outlet cock, and the operation is completed.

The use of compressed air for discharging liquor is, of course, not new. By its adoption, difficulties at the loading station can be got over, time is saved, loss of liquor is avoided, and no smells are given off during the loading and unloading.

THE ASSOCIATION OF WATER ENGINEERS.

THE VISIT TO PARIS—June 9 to 15, 1907.

As a sequel to the twelfth annual meeting of the Association (held at Windsor from the 6th to the 8th of June), the general features of which were described in the "JOURNAL" the following Tuesday (p. 733), the official visit to Paris and its various works of water supply took place the ensuing week, and, in every other respect than numbers, proved an unqualified success. For an Association with a membership roll of 325, a party of 40 (of whom nine were ladies) cannot be considered as representative. But, for various reasons, the visit had to be arranged at a period when parliamentary proceedings and other important engagements claimed the attention of many members who otherwise would have been only too glad to avail themselves of the opportunity of inspecting the water-works of Paris and its environs; and no doubt it will be better if on future occasions such visits as this are arranged independently of the ordinary meetings. Water engineers, as a rule, are busy men; and while a few days may perhaps be spared without inconvenience, an interruption of eleven days is no light matter, especially with Corporation officials, to whom regular attendance at Committee and Council meetings is a duty not readily shirked.

Enough has been said upon this point; and it is pleasant to record the fact that neither the usefulness nor the importance of the visit was prejudiced by the comparatively small number of members who took part in it. On the contrary, had the party numbered 400 instead of 40, the reception accorded to the Association by the Municipality of Paris, by the Water Companies, and by the Society of Civil Engineers of France could not have been more hearty or spontaneous. Even the elements (including the treacherous Channel) favoured the party. A smooth crossing, cool breezes, showers at night or during luncheon, but never when likely to cause inconvenience, contributed largely to the comfort and enjoyment of all concerned, and enabled those intent on gaining information to devote their energies, undistracted by heat, rain, dust, or fatigue, to an intelligent appreciation of the many points of technical interest brought under their notice. In this connection, special mention must be made of the unwearying courtesy and professional sympathy with which questions were answered and information was supplied by the engineers, who, in every case, conducted the party over the various works.

The arrangements were throughout made with a view to the avoidance of fatigue. Thus, arriving in Paris at seven o'clock on Sunday evening (June 9), the first item on the programme was timed for noon on Monday; and the morning hours were left free for independent sight-seeing. Indeed, when started on brakes for the first of the official visits, the first stopping-place was the famous Restaurant de la Cascade in the Bois de Boulogne, where luncheon was served; the engineers connected with the works afterwards visited being entertained as guests of the Association. Rejoining the roomy brakes, the first visit was made to the pumping-station of the Compagnie des Eaux de la Banlieue de Paris, at Suresnes. Situated on the banks of the Seine, these works draw an average daily supply of 6,600,000 gallons from the river, and deliver it to the filtering works and service reservoirs on the heights of Mont Valérien. After a critical survey of the pumping machinery and some comments on the use of large single-cylinder instead of either compound or triple-expansion engines, also much eager inquiry as to the working results in coal or steam consumption per unit of water lifted, the drive was continued up the picturesque and tree-lined road leading to the base of the famous fort. Here, in spite of the magnificent landscape and bird's-eye view of the city, attention was speedily directed to the extensive and interesting filtering works and service reservoirs from which a population of 167,000 people is supplied with river water transformed into a condition of purity altogether beyond the range of criticism.

Having noted the light and simple construction of the reservoirs and filter-beds (*ciment-armé*, or reinforced concrete, having been adopted throughout), the whole of the party were soon absorbed studying the arrangement and working of the "Puech" filters. These have proved so satisfactory in regard to the results obtained that they are in general use, not only by the Company but by the Municipality; and they are shortly to be installed at Bamford, in connection with the important Derwent Valley water scheme now in course of construction under the supervision of Mr. Edward Sandeman, M.Inst.C.E. Full details of the system were furnished in a pamphlet translated by Mr. Easton Devonshire, Assoc.M.Inst.C.E., for the benefit of the members, which will be included in the next issue of the Association's "Transactions."

The ladies of the party were meanwhile entertained by Mme. Chaudoir, wife of the Chief Engineer of the Company, and other ladies; and the curiosity of the gentlemen having been fully gratified by M. Chaudoir and a large contingent of assistants and officials, the visit was brought to a happy and graceful conclusion by a reunion round a table well stocked with light, but welcome, refreshments. Here fitting acknowledgment was made of the hospitality and kindness of the hosts, and, as on subsequent occasions, the cordial reception of English water engineers by their French *confrères* served to forge another link in the *entente cordiale* which now so closely binds the two powerful nations in a bond of mutual sympathy.

Returning to head-quarters at the Hotel Terminus, evening dress was donned, and, refreshed with an excellent dinner, the members filed off on foot towards the handsome building owned by the Société des Ingénieurs Civils de France, in the Rue Blanche. Here the typical gracefulness of the French character was well illustrated by the presentation of bouquets of roses to the ladies of the party. Assembled in the large lecture hall, the President (M. Cornuault) took the chair, and at once proceeded to welcome the visitors in English, his address being subsequently repeated in French. A suitable and witty reply having been made by Dr. Ad. Kemna, the Vice-President of the Association—who, in the regrettable absence of the President (Mr. Sainty), undertook the official duties of his office—the company were shown the plans of the various water-works, and the world-famous system of sewers and pipe subways was also fully explained to them by M. Colmet-Daage, the Chief Engineer to the Municipality. Light refreshments having been partaken of, the party gradually dispersed, all greatly impressed with the interesting nature of the sanitary work of the French metropolis, as well as with the cordial, hearty, and graceful nature of their reception.

Tuesday morning (June 11) was devoted to a visit to the principal sewers; and, escorted by a large array of Municipal engineers and officials, the party were conveyed, partly by electrically-propelled trollies and partly by a chain of barges, through a mile of the largest sewers. These are of a considerable height and are used as pipe subways for the principal water-mains, which are supported on brackets built in the walls of the tunnel. There being a dual supply throughout the city—of spring water (*eaux de source*) and unfiltered river water (for municipal and trade supplies only) respectively, subways for the mains are here particularly desirable They are also used for telegraph and telephone cables, compressed-air pipes, and telegram transmission tubes.

Luncheon having been taken at the Palais d'Orsay Hotel Restaurant, the ladies were released for independent visits to the Louvre Galleries and for shopping expeditions, and the gentlemen took train from the adjoining terminus for Choisy-le-Roi. Here the largest and most important of the works owned by the Compagnie Générale des Eaux were inspected, under the personal guidance of the engineering staff of the Company. The pumping machinery, though of large capacity, did not present any features of special interest beyond the use of single-cylinder engines; but the large and comprehensive installation of Anderson's revolving purifiers, with subsequent sand filtration, attracted close examination and elicited general admiration. The Company is one of the largest water companies in the world, having a capital of 40 million francs, or about £1,600,000 sterling; and the details of their works and the remarkable results obtained by means of the Anderson process in dealing with Seine water, furnished in a pamphlet, translated by Mr. Easton Devonshire, which was supplied to those taking part in the visit, and which will be included in the "Transactions" of the Association, will be of special interest to all water engineers.

The following day (Wednesday) was devoted to an excursion to the Palace of Versailles and the Grand Trianon; and it afforded a pleasant relaxation from the technical parts

of the programme. But the return journey to Paris was arranged to include the village of Marly, where, apart from a magnificent view across the valley of the Seine, the ancient aqueduct erected for the water supply of Versailles was to be seen. At La Machine a stop was made for the inspection of the remarkable battery of eight gigantic water-wheels fixed in a building spanning a wide section of the River Seine, by which spring water is forced to the town of Versailles. The history of these works goes back to the year 1685, and, as explained by the engineers in charge, proved of great interest. At the present time, electrical energy is generated alternatively by a steam turbine or by a water-turbine operated by river water, and is conveyed by cables to the source of supply two miles distant, whence the water is pumped to the works above referred to.

At the luncheon on this day, the opportunity was taken of acknowledging the services rendered by the Organizing Committee, which included Messrs. C. Sainty (President), M. Millhouse (Past-President), Dr. Ad. Kemna (Vice-President), and Mr. Easton Devonshire (Member of Council). The Secretary (Mr. Percy Griffith) was also thanked for his efforts to secure the comfort of those taking part in the trip; and a toast was also given to the ladies of the party.

On Thursday, a morning visit was paid to the enormous two-storeyed reservoir at Montsouris (capacity 45½ million gallons); and a very realistic idea of the dimensions was given by a walk through the galleries which have been constructed in the external walls for purposes of inspection and repair. Somewhat fatigued by this lengthy tour, the members were grateful for a taste of the sparking water flowing into this reservoir from the springs of the Vanne and the Loing, situated more than 100 miles away. The drive included a splendid view of the famous Arcueil aqueduct, conveying Vanne water to Montsouris reservoir. The contrast between the ancient aqueduct built in coursed masonry at a height of 59 feet above the valley, and the more modern aqueduct superposed on it, built in rough uncoursed rubble, at a height of 114 feet, was very noticeable.

After luncheon at the Hotel Terminus, the most important event of the visit (though it was not included in the programme) took place—namely, a reception by the Municipality at the Hôtel de Ville. The arrangements for this could not be definitely fixed until after the programme had been printed; but this fact did not detract in the least from the importance of a function which must be regarded as unique in the history of the Association. Assembled in the hall known as the Grand Salle des Fêtes, attention was drawn at once to the superb proportions and the magnificent decorations of the apartment. This, however, was soon diverted by the entrance of the Vice-President of the Municipal Council and specially appointed representatives of the Prefect of the Seine and the Prefect of Police respectively. Then followed complimentary speeches from all the officials present, and a suitable reply by Dr. Kemna on behalf of the Association. The party were then invited to take light refreshment, and opportunity was afforded for drinking toasts to the President of the Republic, King Edward VII., and the City of Paris respectively. The Vice-President of the Council then conducted the party through the various *salons*, including the Council Chamber and the covered court adjoining, which was in process of decoration for the visit of the King of Denmark on the following day. Work was suspended in order that the lights intermingled with the floral decorations might be switched on, and those present were thus afforded an experience as unique as it was unexpected.

The afternoon was left free of official appointments; and many members took the opportunity of inspecting the Salon, or Exhibition of Pictures in the Grand Palais in the Champs Elysées.

The programme for the last day included a drive to Montmartre, where the three storeyed reservoir built on the summit of the hill was fully inspected, and its peculiar features were thoroughly investigated and appreciated. A visit was also made to the adjoining church of the Sacred Heart; and it being a *fête* day, the decorations and the crowds attending Mass proved a great attraction, and rendered it a matter of some difficulty to secure strict adherence to the time-table. The drive was again interrupted to allow of the inspection of the pumping-station at La Villette, where some fine Corliss engines were at work, pumping Seine water from the adjoining Ourcq Canal to the Montmartre reservoir and into the public service-mains throughout the city.

Luncheon having been served at the Restaurant de la Porte Jaune in the Bois de Vincennes, the ladies were released for the afternoon, and the gentlemen were driven to the Municipal filtering-works and pumping-station at St. Maur. Here some ancient water-wheels operating force-pumps, also some vertical turbines, all worked by the River Marne, attracted special attention. But interest mainly centred in the exhibition of various filtration systems, including sterilization by ozone and the use of ferroclore for clarification and filtration. Some members of the party attended specially to inspect these plants; and they were busily engaged taking samples of the water and making inquiries into the details of working throughout the visit. Finally, a visit was made to the "Puech" filtering-works at Ivry, some particulars in regard to which, as well as those at St. Maur, were furnished in another pamphlet. After these had been inspected with undiminished enthusiasm, the members returned to head-quarters somewhat fatigued, but none the less delighted with the many interesting and useful items of information they had acquired.

In the evening, the various engineers of the works inspected were entertained at dinner at the Hotel Terminus, after which the toast-list afforded the Acting President (Dr. Kemna) an opportunity of expressing the hearty thanks of the members for their reception, and for the valuable information which had been so courteously and readily afforded throughout the visit. A pleasing function took place on this occasion, in the presentation to M. Marbontin, who had been largely responsible for the arrangements of the visit, of a silver cigarette-case subscribed by those present. The gift was handed to Mme. Marbontin by Dr. Kemna, who humorously suggested that she would no doubt control the use of it by her husband.

In view of the nature of the reception accorded to the Association on this occasion, it seems only reasonable to suggest that an early opportunity should be provided for a second visit, as by thus promoting friendship and sympathy between the water engineers of the two countries the Association would not only promote the interests of the profession generally, but would also enlarge the knowledge and experience of the members.

A pamphlet entitled "The History and Description of the Water Supply of Paris," compiled and translated from official information by Mr. Easton Devonshire, was specially prepared by him for the visit, and will be included in the "Transactions" of the Association. This and the other pamphlets referred to are noticed below.

THE HISTORY AND DESCRIPTION OF THE WATER SUPPLY OF PARIS.

As mentioned in the account given above of the recent visit to Paris of a party of members of the Association of Water Engineers, a pamphlet giving some historical and descriptive particulars of the water supply of the city was prepared by Mr. Easton Devonshire, Assoc.M.Inst.C.E. The following are some extracts from it.

Historical and Statistical.

A hundred years ago the public water supply of Paris was obtained from the following sources, which together provided daily, either by gravitation or pumping, approximately, 8000 cubic metres of water; the population of the city being then 547,700 persons.

	Cubic Metres. 1 c.m. = 220 gals.
Spring water—	
Prés Saint Gervais (northern springs)	171
Belleville (northern springs)	114
Arcueil (southern springs)	952
Seine water—	
La Samaritaine pumps	400
Notre Dame pumps	914
Chaillot "fire-pumps"	4132
Gros Caillou "fire-pumps"	1303
Total	7986

These sources supplied a certain number of public establishments, 83 public fountains, and 45 private concessionaries, either gratuitously or by payment.

The springs of Prés Saint Gervais and Belleville were brought

to the city by two small aqueducts, constructed at an early period by the monks of St. Laurent and of the Abbey of St. Martin des Champs; the first aqueduct being composed of pipes of pottery or stone, and the second of arched stone galleries provided with monumental inspection chambers, which date from 1457. The southern springs were conveyed to the city by the Arcueil aqueduct, inaugurated in 1624 by Louis XIII.; the first stone having been laid in 1613 by Marie de Médici. The pumps of "La Samaritaine" were erected under the second arch of the Pont Neuf, near the Louvre, in the reign of Henry IV. (1600) by Jean Lintlaer, a Flemish engineer, for the supply of the Louvre and Tuileries. They consisted of a suspended water-wheel driven by the flow of the river, and actuating pumps raising at that time 710 cubic metres of water daily to a reservoir constructed in the cloister of Saint-German l'Auxerrois. The pumps of Notre Dame, erected on the same plan in 1669 by Jolly and Demanu, raised as much as 1600 cubic metres per day. The "fire-pump" erected in 1781 at Chaillot, a village below Paris, consisted of two steam-engines of 69 H.P. each, of the Newcomen type, with wooden beams; and they raised the river water into four reservoirs built near together in the neighbourhood. The "fire-pump" of Gros Caillou, built shortly afterwards on the opposite bank of the Seine, comprised two steam-engines of 14 H.P., and pumped into a water-tower.

In 1802, during the Consulate of Napoleon, the Legislature decreed the construction of a "canal of derivation" of the waters of the River Ourcq, by which the whole volume of the river—an effluent of the Marne, was diverted at Mareuil at a distance of 97 kilometres to the north-east of Paris into the Canal de l'Ourcq, which terminates at the Bassin de la Villette, whence it was distributed through the city by an underground gallery, known as the "Aqueduc de Ceinture" and by a system of conduits. In 1813 the Canal de l'Ourcq was opened for navigation. But the works in connection with it were suspended in 1814 at the fall of the First Empire; and it was only during the first years of the Restoration that their completion, together with the construction of the Canal of Saint Denis, which also terminates at the Bassin de la Villette, was entrusted to the Company Vassal and St. Didien, to whom was granted a concession for 90 years to date from Jan. 1, 1823. This Company further undertook the construction of a third canal—viz., that of St. Martin. The concession to the Company was put an end to by the purchase by the City of Paris of the St. Martin Canal in 1861 and of the Ourcq and St. Denis Canals in 1875. To reach the higher levels of the old city, a large iron tank supported on a masonry tower, and known as the "Cuve de Chaillot" was erected during this period above the village of Chaillot.

A feature of the supply at the beginning of the Nineteenth Century was the sale of water by water carriers, who hawked water obtained from public tanks known as "*fontaines marchandes*," paying the City for it at the rate of 90 c. per cubic metre. This trade dated from 1786, and grew to considerable importance, especially after 1819, when a decree issued by the Prefect of Police forbade the filling of water-carts from public drinking fountains. The water sold, however, was far from good, and in 1821 experiments in filtration were made at the "*fontaine marchande*" of Boule Rouge. The filtering material was broken stone, charcoal, and fine sand, and was the forerunner of various types of filters, of which a small one of porous stone became largely used by private consumers. A company was eventually formed for the sale of filtered water and erected a plant at the Quai des Célestins, on what was known as the Vedel and Bernard system; the water being conveyed to the inhabitants in large carts.

The sinking in 1832 of an artesian well at Grenelle and additions to water pumped from the Seine increased the supply, so that in the year 1854 it amounted to 80,400 cubic metres, from the following sources: Ourcq Canal, 60,000; Seine water, 19,000; Arcueil water, 300; Grenelle well, 900; northern springs, 200.

In 1854 an entirely new programme was decided upon, and in 1856 Belgrand initiated the system of a dual supply, which is in use at the present time. In conformity with his plans, two entirely distinct supplies were created—the one for public uses, trade purposes, courtyards, stables, and gardens, and the other for domestic uses only. Two systems of mains were established—the first for the public and the second for the private service. The existing sources of supply from the Ourcq Canal and the Seine, as well as the hard waters of the northern springs, were reserved for the public service; while a new supply from distant springs was sought for and eventually brought into Paris in covered aqueducts. At the same time the city was divided into zones, whose varying levels could be reached by gravitation, or, where necessary, by pumping to reservoirs. For the private service Belgrand brought into Paris the spring water of the Vanne on the south and that of the Dhuis on the north-east; while additional water for the public service was obtained from pumping-stations at Austerlitz on the Seine and Saint Maur on the Marne.

On the death of Belgrand, in 1878, the supply of Paris was as follows: River water (Ourcq, Seine, and Marne) 241,000 cubic metres; spring water (Arcueil and artesian wells, Dhuis, and Vanne) 129,000 cubic metres—total 370,000 cubic metres. The programme initiated by Belgrand was continued and extended, under the administration of Alphand, as Director-General of Public Works, by MM. Couche and Humblot, successively Engineers-in-Chief of the water and drainage service. Under the administration of M. Humblot and of M. Bechmann, the Chief Engineer of the Water and Drainage Department, the Avre project was complete in 1893, adding 100,000 cubic metres daily to the private service; and 50,000 cubic metres more were added in the last years of the past century from the springs of Loing and Lunain. A supplementary supply of 70,000 cubic metres of filtered water from the Seine and the Marne was further secured by the construction of filter-beds at St. Maur in 1897 and at Ivry in 1899. In connection with these additional supplies, reservoirs were built at Passy, Charonne, and Montretout, and further pumping machinery erected at St. Maur, Ivry, and Place St. Pierre.

As the result of the great works undertaken during the last half of the Nineteenth Century, the supply of Paris in 1900 was as follows:—

Private Service.

Spring water of the Dhuis	20,000 cubic metres.
,, ,, ,, Vanne	120,000 ,, ,,
,, ,, ,, Avre	100,000 ,, ,,
,, ,, ,, Loing and Lunain	50,000 ,, ,,
Total	290,000 cubic metres.
Filtered river water	70,000 ,, ,,

In dry weather the delivery of the springs falls as low as 210,000 cubic metres; so that the whole private service supply ranges between 370,000 and 270,000 cubic metres daily, or from 135 down to 104 litres per head of the population.

Public Service and Trade Supply.

Ourcq Canal	150,000 cubic metres.
Seine water	260,000 ,, ,,
Marne water	120,000 ,, ,,
Artesian wells and old aqueducts	7,000 ,, ,,
Total	537,000 cubic metres.

The united supplies amounted to 790,000 to 870,000 cubic metres, or from 304 to 355 litres per head.

The consumption of water during 1906 was as follows:—

Private Service.

Spring water, average per day	262,670 cubic metres.

Public Service and Trade Supply.

Ourcq water, average per day	122,840 cubic metres.
Seine water ,, ,, ,,	252,140 ,, ,,
Marne water ,, ,, ,,	81,650 ,, ,,
Artesian wells ,, ,, ,,	6,090 ,, ,,
Total	462,720

The total water supply for all purposes during the year was 264,766,500 cubic metres, with a daily average of 725,390 cubic metres (159,585,800 gallons), for a population of 2,722,731 persons, according to the census taken in 1905, which is equivalent to 266·4 litres, or 59 gallons, per head per day.

The period of transformation of the system of water supply in accordance with Belgrand's scheme coincided with the enlargement of the municipal boundaries, so as to include the whole territory within the line of fortifications—absorbing the intramural communes which previous to 1859 had been separately administered. These communes, as well as others outside the ramparts, were supplied by the Compagnie Générale des Eaux under the terms of various concessions. The transfer to the city was complicated by the fact that the charges for water made by the Company were considerably higher than those imposed by the Municipality; the annual rate per cubic metre of daily supply being 50 frs. for Ourcq water and 100 frs. for Seine water in the city, compared with 180 frs. in the communes, which were supplied by the Company with water drawn from the Seine below Paris.

An arrangement was effected in 1860 by which the Company handed over to the Municipality their pumping-stations at Port-à-l'Anglais, Maisons Alfort, Auteuil, Neuilly, Clichy, Saint Ouen, and Charonne, together with their corresponding reservoirs, 259,000 metres of mains, the "*fontaines marchandes*," and the whole of its plant within the Department of the Seine, and transferred to the city all its rights under the concessions it enjoyed. As consideration for this transfer of their property, the Company were granted a concession for fifty years, under the terms of which they became lessees of the Municipality, and undertook the commercial exploitation of the supply, including the making of agreements with consumers, the sale of water, the laying and maintenance of connections to mains, and the collection of rates. The City agreed to pay the Company an annuity of 1,160,000 frs. (representing the amount of the Company's net profits at the time), an allowance of 350,000 frs. per annum to cover the cost of "farming" the receipts, and one-fourth of the profits in excess of 3,600,000 frs. The charge for Ourcq water was fixed at 60 frs. per cubic metre of daily supply, and that for Seine water at 120 frs. The contract of 1860 was, however, altered by mutual consent in 1867. Subsequent contracts, made in 1869 and 1880, modified the previous agreements, notably as regards the charges for water; and in 1894 new regulations were made as to the supply of spring water. This dual system of administration, which leaves the Municipal authority the ownership and maintenance of the sources and works of supply, while the Company are responsible for everything relating to the sale of water to private consumers, has worked satisfactorily, and is still in operation.

The Pumping Stations and Wells.

After giving, by the aid of a map and diagrams, a description of the springs and aqueducts connected with the private service supply of the city—viz., the spring of the Dhuis, the Vanne, the

Loing and Lunain, the Avre, and filtered river water—Mr. Devonshire proceeds to deal with the public service supply, which is obtained mainly from the Ourcq Canal, the Seine, and the Marne. The river water is pumped from intakes at the pumping-stations of Ivry, Austerlitz, Bercy, Chaillot (Auteuil), and Javel on the Seine, and Saint Maur on the Marne. The most important of these stations are at Ivry and Saint Maur, the former supplying 200,000 cubic metres of unfiltered river water to reservoirs at Villejuif and Charonne, and the latter 110,000 cubic metres to the lower compartment of the Mènilmontant reservoir, both works also pumping filtered water into the private service mains when required.

The Ivry pumping-station consists of the old and new works; the latter being 250 metres higher up the Seine than the former. The old works, as constructed in 1881-3, contained six engines of 150 H.P., capable of raising 85,000 cubic metres of water per day. Three more engines of 170 H.P., to pump 50,000 cubic metres, were added in 1899. In these new works, the machinery consists o eight engines of 200 H.P. each, of which four are reserved for pumping filtered water from the plant erected at the works. The water pumped by the Ivry stations is conveyed partly to the Villejuif reservoir by two mains, 1·10 metres and 0·80 metre diameter respectively and 4300 metres long, laid in the ground for the most part, bnt passing through masonry culverts in the populated district of Ivry, and partly to the Charonne reservoir by two mains laid in a trench.

The pumping-station of Saint Maur is situated at Joinville-le-Pont, on the navigation canal which cuts through the isthmus at the bend of the river, and occupies the site of the ancient mills of Saint Maur, which were purchased by the City in 1863. The station comprises four distinct works, of which two utilize the water from the old mills, with a fall increased to 4·10 metres, and two provide steam power for pumping filtered water and unfiltered water respectively. The aggregate pumping capacity of the works is 23,000 cubic metres of filtered and 110,000 cubic metres of unfiltered water per 24 hours, of which 12,000 cubic metres supply the Gravelle Lake at an altitude of 72 metres. and the remainder is raised to the lower compartment of the Mènilmontaut reservoir at the level of 100 metres above datum. There are five rising mains, of which one, 50 cm. in diameter, supplies the Gravelle Lake; one, 60 cm. and two 80 cm. in diameter, reach the Mènilmontant reservoir by different routes, of a total length of 11 kilometres; and the fifth, 1·10 metres in diameter and 6300 metres long, conveys filtered water only to the Place Daumesril, where it connects with the distributing mains of the spring water supply. The filtering plant comprises six filter-beds with decanting tanks. The works at the Austerlitz pumping-station, constructed on the Quai d'Austerlitz in 1863 and enlarged in 1898, originally contained two vertical beam engines of the Woolf type, with vertical double-acting pumps; each engine being of 110 H.P. The new engines, two in number, each of 180 H.P., are of the horizontal Corliss pattern, with Girard pumps, and are supplied by four semi-tubular boilers. They pump into three cast-iron mains, of which two, 50 cm. in diameter, laid when the works were built, supply the Gentilly reservoir in one direction and the Charonne reservoir in the other, at the level of 82 metres above datum in both cases. The third main, laid in 1897, connects with one of the supply-mains of the Villejuif reservoir at the level of 89 metres, and also supplies a tank near the Gentilly reservoir. The total volume of water pumped from this station is 56,000 cubic metres per 24 hours.

The Bercy pumping-station was built in 1889, the Auteuil station in 1832, and the Javel station in 1887. In addition, there are four relay stations—viz., the Ourcq, the Mènilmontant, the St. Pierre, and the Charonne.

Artesian wells contribute very little to the water supply of Paris, although acquiring considerable celebrity at the time of their first construction. The oldest of these wells, sunk at Grenelle, was commenced in 1833, but was not completed until 19 years later. The boring reaches the greensand formation underlying the cretaceous stratum at a depth of 500 metres; the water rising to a height of 38 metres above the ground to the summit of the cast-iron column erected on the Place de Breteuil. Its original flow of 950 cubic metres per 24 hours fell suddenly to 600 cubic metres on the completion of the Passy well, and now amounts to 400 cubic metres only. The water is limpid and soft; but its temperature is high, aud it is mixed with the river water for the public service. The Passy well, sunk at the Place Lamartine, where the water rises to the level of some 53 metres above datum, delivers a much larger volume—nearly 5000 cubic metres—similar in character to that of the Grenelle boring, but containing some sulphur. It is used for the supply of the lakes in the Bois de Boulogne. The boring was undertaken in 1855 by M. Kind, at the contract price of 350,000 frs., but was abandoned by the contractor two years later owing to a serious accident, and was finished by the City in 1861. Its diameter is 1·10 metres at top, reduced to 70 cm. when it enters the greensand at a depth of 586·5 metres; and it is lined with oak tubbing, strengthened with iron hoops and vertical rods. Two other wells—one at the Place Hébert and the other at the Butte aux Cailles—have since been sunk; the first, commenced in 1884 and finished in 1891, reaching a depth of 718 metres, and supplying 2000 cubic metres of water to a public swimming bath, and the second was in course of completion in 1900, when it had reached a depth of 566 metres.

The Reservoirs.

Paris is divided into two principal zones. Of these, the central or low-level one extends in approximately equal areas on both sides of the Seine, and may roughly be said to take its supply for public service from the Ourcq on the ground-floor level, and for private service from the Vanne and the Loing on the upper floors of the houses. In a similar manner the outer or high-level zone is supplied by unfiltered river water from the Seine and Marne for low-pressure, and with Avre and Dhuis spring water for high-pressure requirements. Isolated districts on the heights of Montmartre and Belleville to the north, and a small district in the neighbourhood of the Montsouris reservoir to the south, may be grouped together as forming a third zone, which is reached by the aid of the relay pumping-stations already referred to. The reservoirs corresponding to this broad division of the zones of distribution have their overflows at levels ranging from 52 metres down to 47 metres above datum for the Ourcq supply, and from 79·50 to 75·50 metres for that ofthe Vanne and the Loing in the central zone; from 89 to 65 metres for Seine water, and from 108 to 107 metres for Avre and Dhuis water in the outer zone, in the supply of which Marne water from the Mènilmontant reservoir at the level of 100 metres also participates; and from 131 to 97 metres for river water and 136 to 134 metres for spring water in the isolated districts of the northern and southern heights.

The Mènilmontant reservoir is the oldest and the largest of the reservoirs holding different waters in separate compartments; and it was built by Belgrand in 1865 on the high ground on the north-east of the City territory. It consists in effect of two reservoirs, one above the other, the upper being in the form of a half circle with a radius of 95·40 metres, completed by a rectangle measuring 190·80 metres by 44·80 metres, and the lower approximately a square with sides 100 metres long. The upper division receives the flow of the Dhuis aqueduct, and has a storage capacity of 100,000 cubic metres (22 million gallons), with a depth of 5 metres of water; its overflow being at the level of 108 metres above datum. The lower division receives the unfiltered water pumped from the Marne at Saint Maur, and holds 28,000 cubic metres (6,160,000 gallons), with a depth of 4 metres of water; its overflow level being 100·20 metres.

The Montsouris reservoir, situated on the southern boundary of the City, was built under Belgrand at the same period as the Vanne aqueduct (1871-1874), by which it is supplied; the Loing aqueduct being connected to it in 1899. It is built in the form of a rectangle, 265 metres long and 136 metres wide, and consists of two divisions, one above the other. The upper portion, divided by a cross wall into two square compartments, has a capacity of 80,000 cubic metres (17,600,000 gallons), with a depth of water of 3 metres, and an overflow level of 80 metres above datum. The lower portion is also in two compartments, holding 126,400 cubic metres (27,800,000 gallons); the full depth of water being 5·50 metres, and the overflow level 73·75 metres—these compartments being filled from the upper portion of the reservoir, either from the overflows or by pipes connecting the two divisions. The construction is entirely of stone-grit masonry in cement mortar, except for the arches, which are formed of very light bricks of a type adopted by Belgrand, and subsequently employed in most of the Paris reservoirs; the arches being carried on brick columns and abutments.

The Saint Cloud reservoir, which is situated on the heights of Montretout at the outlet of the Avre aqueduct, contains three compartments on the same level, of which two were completed in 1894, and the third in 1900. The reservoir has a total capacity of 300,000 cubic metres (66 million gallons); and with buildings it covers an area of over 83,000 square metres (21 acres). It is in the form of a rectangle, 418 metres long by 352 metres wide, divided by cross walls; its depth of water when full being 5 metres, and its overflow level 107 metres above datum. The aqueduct discharges into a tank placed at the western end of the wall dividing the first two compartments, where it is covered by a light structure of iron and glass. The reservoir floor, walls, and roof supports are constructed of stone-grit masonry in portland cement mortar, with a cement rendering over the whole of the inside surface. The arches are composed of two courses of light bricks, 3 cm. thick, laid in portland cement. The roof of each compartment is divided into twelve squares of straight and groined arches combined, all having a span of 5 metres and a rise of 60 cm., and springing from square columns 50 cm. by 0·50 cm. The floor is 0·35 cm. thick, with a slight fall towards the delivery and waste outlets.

The Villejuif reservoir, which receives unfiltered Seine water pumped from Ivry, was designed to hold 50,000 cubic metres in four compartments, of which two were built in 1881-3. It stands on the side of a hill to the south of Paris, near the village of Villejuif, and, owing to the unstable nature of the soil, required special precautions in making its foundations. The floor is double, and formed of galleries of elliptical section, which serve as drains and also carry all the pipe connections. It is roofed over with light brick arches, and covered with a layer of earth, with long abutments separated from the outer walls by a space to avoid excessive thrust. The depth of water in this reservoir is 5 metres, and its overflow level 89 metres above datum.

The Montmartre reservoir is an architectural structure, 18 metres high, ornamented with stone balustrades and turrets. It holds 11,000 cubic metres of water, divided among three superposed compartments forming three floors, which are in turn supported on a foundation of arched galleries; the substructure serving both as a protection against leakage water and a space for lodging the various pipes supplying the different levels. The

lower storey receives river water in two compartments, with a depth of 5 metres and an overflow level of 127·30 metres above datum. The second storey, which entirely covers the one below, has a depth of 3·50 metres of spring water, is also in two compartments, and has an overflow at the level of 132 metres. The fifth compartment on the top storey only partly covers the floors below; it also receives spring water with an overflow level of 136 metres—both spring and river supplies being pumped from the station in the Place Saint Pierre. The somewhat perilous situation of this reservoir—on a sandy soil, 80 metres above the surrounding streets—necessitated extremely strong construction. Its foundation consists of a double bed of concrete with an intermediate rendering of portland cement; and the masonry of its walls is strengthened by bands of iron at each floor.

The larger Passy reservoir, as distinguished from the older reservoir purchased from the Compagnie Générale des Eaux, in 1860, and since disused, is situated at the Place du Trocadéro, and consists of six compartments, of which five receive river water and the sixth spring water from the Avre aqueducts. Four of the compartments are in pairs, superposed; one of the two upper compartments being covered for the storage of 6000 cubic metres of spring water, the others, together with a fifth compartment at the lower level, holding 29,000 cubic metres of river water. The overflow level of all the upper compartments is 75·33 metres. These five compartments were constructed in 1858. A sixth compartment, built in 1899 on the lower level, has a capacity of 22,000 cubic metres and a depth of 5 metres. It is uncovered, as are also the fifth compartment and the upper compartment for river water.

The Charonne reservoirs are two in number, separated by the Rue des Prairies, to the east of Paris. The older reservoir, of a capacity of 5600 cubic metres at a level of 80·70 metres, is connected to the reservoir built in 1899, and containing 23,500 cubic metres, with an overflow level of 82 metres. These reservoirs, which can be used either together or separately, store Seine water pumped from the Ivry and Austerlitz works, and can also be supplied from the Bercy pumping-station, or from the Marne by a connection to the Saint Maur mains.

The Gentilly reservoir is situated to the south of the city, at a short distance outside the Porte d'Arcueil. Its level is 82·10 metres above datum, and it is divided into two compartments, holding 10,300 cubic metres, constructed respectively in 1865 and 1882. It is supplied from a tank of 200 cubic metres capacity, erected in 1898 in proximity to it at the overflow level of 88·50 metres, with water pumped by the Austerlitz station with a connection to the mains from the Villejuif reservoir. The Gentilly reservoir feeds the low-level reservoirs of Grenelle and the Panthéon. Of the last-named reservoirs, that of Grenelle, situated in the south-west of the city, is an open construction in two compartments, with a capacity of 6500 cubic metres. The Panthéon reservoir, to the south of this district (the supply of which it also supplements), is a small construction of two compartments with an overflow level of 65 metres above datum.

The gravitation supply to the low-level district may be said to have four reservoirs—that formed by the Bassin de la Villette, at the termination of the canal, being one. The three others, which serve as equalizing or compensation reservoirs, from the termini of the three conduits which run from the Aqueduc de Ceinture, on the north, to three points on the southern limit of the low-level zone. The highest of these reservoirs is the Saint Victor, constructed in 1846, and holding 7000 cubic metres of water, with a depth of 5 metres and an overflow level of 48·40 metres above datum. The second, known as the Vaugirard, built in 1840, is practically at the same level, and holds 8930 cubic metres in two compartments, 4·70 metres deep. The third, built four years earlier, is the Racine reservoir, divided into three compartments with a top-water level of 46·80 metres. The Ourcq water supplying these reservoirs flows from the Bassin de la Villette at the level of 52 metres.

This enumeration of the reservoirs of Paris may be completed by the mention of the relay reservoir of Buttes Chaumont, which receives Ourcq water pumped from the Ourcq station, in two compartments of 8800 metres capacity at the altitude of 97 metres; the Saint Pierre tank, erected on a water-tower in 1888 at the level of 83·56 metres, and feeding the Passy and Charonne reservoirs with Seine water pumped at Bercy; and, lastly, the Belleville reservoir, constructed in 1863, on the high ground to the north-east known as the Butte du Télégraphe, and holding in two superposed compartments, of a total capacity of 18,000 cubic metres, spring and river water raised by the engines of the Ménilmontant relay station—the spring water reaching a level of 134·40 metres, and the river water overflowing at a height of 131·10 metres above datum.

Distributing Mains and Appliances.

The total length of mains of all sizes and materials is little short of 2500 kilometres (1560 miles). Their diameters range from 27 to 135 mm. in lead pipes; and from 41 mm. to 1·10 metres in cast-iron, with 1338 metres of a diameter of 1·30 metres in armoured concrete, and 3564 metres, 1·15 metres in diameter, of steel pipes. As a general rule, all pipes, both large and small, are laid in the sewers or in dry subways built over them. It is claimed that the facility of inspection and the detection and repair of leaks afforded by this system, adopted generally by Paris alone among the cities of the world, outweighs the increased cost involved in the first instance. The cast-iron pipes employed are of special form, being made with two plain ends without socket, flange, or bead. The lengths of pipe are placed end to end with a space of a few millimetres between them; this space being closed by a covering fillet of clay. Short double sockets cast with a slight taper are slipped over the joint, and held in position by wedges; while lead is run in from both ends, and set up on both faces. In case of a length of pipe having to be renewed, the taper of the collar allows it to be knocked off the joint with a few blows of a hammer, and the lead is cut off cold. The pipes are generally carried on cast-iron brackets let into the side walls of the sewer; the larger mains being laid on masonry blocks or small cast-iron columns placed on the set-offs provided for the purpose in the larger subways, or supported on joists fixed from wall to wall. For the control of all mains of 10 c. (4 inches) diameter or less, plug cocks are used; the pattern adopted for some years past being that known as the "Gibault" cock, which is made of gun metal, the conical plug having its big end downwards. For larger diameters, sluice-cocks of the usual type are employed, with full-way for all sizes of mains up to 0·90 cm., 100 cm., and 110 cm., for which sluice-cocks having an opening of only 80 cm. diameter are generally used as being lighter.

All drinking fountains, wall fountains, and stand-posts for drinking purposes are supplied with spring water. The fire hydrants—7000 in number, and placed 100 metres apart—are also served from the spring-water mains, which alone provide the requisite pressure. For washing the streets and the boulevards, Ourcq and river water is supplied to 7800 hydrants placed in the gutters. The street-watering hydrants, 7000 in number, have outlet orifices 4 cm. in diameter, to which are coupled jointed pipes on roller wheels, which run on the surface of the street in any direction at the will of the man directing the short length of hose and nozzle attached to them. For filling water-carts, fixed pipes rising above the ground to the requisite height, and known as "swan-necks" from their shape, are screwed on to the watering hydrants at convenient centres. Ornamental fountains are very numerous in Paris, especially in the low-level zone, where they are supplied by gravitation from the Ourcq Canal, and run daily, whereas those in the higher districts, supplied with water pumped from the Seine or Marne, reserve their displays for Sundays and holidays.

The pamphlet closes with some remarks on the conditions of supply to private consumers, and on the financial results of the water undertaking in the year 1900—the date of the official publication prepared for the International Exhibition by M. Bechmann (then the Chief of the Technical Service of Water and Sewerage), from which, as well as from that gentleman's successor, M. Colmet-Daage, Mr. Devonshire obtained his information.

PARIS WATER-WORKS AND FILTRATION PLANT.

In connection with the historical and descriptive particulars of the water supply of Paris which is given above, it will be of interest to publish an account of the two Companies who are largely responsible for maintaining the supply, as well as of the plant which they and the Municipality have installed for rendering it as pure as possible. This we are able to do from one of the very interesting pamphlets by Mr. Easton Devonshire, Assoc.M.Inst.C.E., issued to the members of the Association of Water Engineers on the occasion of their recent visit to Paris.

The Water-Works.

In the course of the historical particulars above alluded to, the arrangement come to between the Municipality and the Compagnie Générale des Eaux, for the transfer of their works to the City, and for the "farming" of the supply by the Company, was briefly mentioned. The Company was formed in 1853, with a capital of 20,000.000 frs. (£800,000), which was increased to 40,000,000 frs. (£1,600,000) in 1881. The suburban districts supplied by the Company extend almost round Paris, and now comprise 131 communes in the Departments of the Seine, Seine-et-Oise, and Seine-et-Marne, with a population of about 900,000 inhabitants. In addition to owning and administering the water supply to this large territory, the Company are responsible, as stated elsewhere, for the commercial management of the water supply of the City of Paris, with its 2,750,000 inhabitants, collecting water-rentals from consumers, laying connections, and fixing meters, under its contracts with the Municipality.

At Choisy-le-Roi there are four engines of the Farcot type, each capable of raising 17,000 cubic metres of water per 24 hours, and four Corliss engines built by the Fives-Lille Company, each pumping 11,000 cubic metres per day. At Neuilly-sur-Marne there are also eight engines, of which two of the Farcot type deliver 17,000 cubic metres each; four Corliss engines, constructed at Fives-Lille, each of 11,000 cubic metres; and two Worthington pumping-engines, of 12,000 cubic metres each. In addition to these, the Neuilly-sur-Marne works are provided with a Laval turbine capable of raising 70,000 cubic metres of water daily to the filter-beds.

The pumps are of the "Girard" type; each engine actuating a single-acting pump for the low lift to the revolving purifiers and filter-beds, and a double-acting pump for raising the filtered water

to the reservoirs. This method of combining the low and high lift pumps with each set of engines ensures the pumping of the water in relation to the quantity filtered.

The pumpiug-stations at Boulogne-sur-Seine, Neuilly-sur-Seine, Saint Denis, and Epinay, situated below Paris, have been abandoned as sources of supply of potable water. The supplying stations are grouped in two principal centres—on the Seine at Choisy-le-Roi, and on the Marne at Neuilly-sur-Marne, with a third smaller station at Nogent-sur-Marne. Some idea of the size of these three stations, and of their rapid development, is given by the following table, which shows the relative figures of the horse power of the pumping machinery, and the area and delivery of the filter beds:—

Date.	Horse Power.	Filter Area. Sq. Met.	Delivery. Cub. Met.
Jan. 1, 1896	1100	19,375	70,000
July 1, 1900	2250	39,250	130,000
Jan. 1, 1907	3450	48,500	195,000

The water from the Seine and the Marne, purified and filtered, is pumped iuto two large reservoirs placed 122 metres above sea level—one at Montreuil to the north-east, and the other at Villejuif to the south of Paris, forming the heads of the trunk mains. Two reservoirs have been built at a lower level on the western and northern boundaries of the Company's district at Puteaux and Pierrefitte, receiving the overflow from the mains, and furnishing a reserve in case of great draught. All these reservoirs are connected to the pumping-stations by an unbroken ring of mains of 500 mm. (20 inches) to 800 mm. (32 inches) diameter, allowing the stations to mutually support each other. Less important reservoirs of either masonry, reinforced concrete, or iron, situated on the heights of Fontenay, Robinson, Chatillon, Les Lilas, Avron, and Champigny, are supplied from pumping-stations providing first or second relays, and permit of reaching the highest points in the Department. The length of mains of large diameter for high lift and supply exceeds 1300 kilometres (810 miles); while the general network of mains amounts to 2300 kilometres (1437 miles).

We now come to the works of the Company supplying the suburbs—the Compagnie des Eaux de la Banlieue. In 1864, the communes of Suresnes, Nanterre, Rueil, Asnières, Gennevilliers, and Colombes granted a concession for the supply of water for domestic, industrial, and agricultural uses to M. Adrien Dumont; while a similar concession was placed with M. Léopold de la Vallée-Poussin, Director of the Compagnie Générale des Conduites d'Eau, of Liège, for the supply of the commune of Courbevoie. These two concessions were transferred in 1867 to the Suburban Water Company, whose original capital of 2,000,000 frs. was increased in 1883 to 2,500,000 frs. At that time the population of the suburbs included in the communes was 36,000; but it has grown to 167,000 at the present time. The district supplied is nearly 23 square miles in area, and, with the exclusion of Puteaux, is practically coterminous with the territory lying within the loop formed by the Seine to the north-west of Paris. The length of mains has increased from 42 kilometres (30 miles) in 1867 to 350 kilometres (220 miles) in 1907. The concession fixed at 60 years for several of the communes has since been prolonged, expiring for Asnières, Colombes, and Bois-Colombes in 1925, and for Courbevoie in 1929. The number of consumers separately supplied is now 17,136; and the aggregate value of the water-rentals 872,597 frs. The average daily consumption approximates 30,000 cubic metres (6,600,000 gallons), with a maximum of 35,000 cubic metres (7,700,000 gallons).

The water is drawn from the Seine immediately above the "barrage" at Suresnes, and reaches the pump-sumps by a culvert 140 metres in length. There are four groups of engines and pumps. The boilers are six in number—two (of the Galloway type) with a heating surface of 125 square metres (1250 square feet); and four, with superheaters, of 100 square metres (1000 square feet) heating surface. There are three rising mains from the pumps to the reservoirs, of the diameters of 600 mm., 500 mm., and 250 mm. (24 inches, 20 inches, and 10 inches) respectively. The four groups of machines are capable of lifting 70,000 cubic metres of water daily.

Before the installation of the filtering plant, which will be described later, the district was supplied from two principal distributing reservoirs, of which one is situated on the heights of Mont Valérien, at the level of 91·94 metres above datum, supplying the communes of Suresnes and Rueil; and the second at the Rond Point des Bergères, at an altitude of 71·50 metres, supplying Nanterre, Courbevoie, Asnières, and Geunevilliers. There are in addition seven secondary reservoirs, of similar construction to the last, placed at various points and levels in the district; the total storage capacity of these reservoirs being about 20,800 cubic metres. In connection with the construction of the filtering installation on Mont Valérien, a new reservoir has been built to hold a further 19,000 cubic metres.

The mains now measure 350 kilometres (220 miles), and are of diameters varying from 800 mm. to 40 mm., controlled by 1300 sluice-cocks. The supply for public uses is provided by 630 hydrants for fire, street-watering, and sewer-flushing purposes, 60 hydrants for fire purposes only, 48 connections for flushing sewers, 8 monumental fountains, 69 staud-posts, and 10 urinals.

The Purification and Filtration Plant.

Iu July, 1892, the Compagnie Générale des Eaux were invited by the Prefect of the Seine to study the measures to be taken to improve the quality of the water supply of the Paris suburbs. Experiments had been made from 1890 to 1892 at Boulogne-sur-Seine with a plant for 500 cubic metres per day, and subsequently with an installation for 5000 cubic metres. After the results obtained had been verified by the Laboratory of Montsouris, the Company, on Jan. 20, 1894, entered into an agreement with the Department of the Seine by which they undertook (1) to utilize the lower water for hygienic and trade purposes only, (2) to draw from above the city the whole of the water intended for the potable supply, and (3) to purify this water by treatment with metallic iron followed by filtration through sand. The works comprised in this programme, which involved a total outlay of 12,000,000 frs., were completed Jan. 1, 1896, and gave the results expected from them.

The method of treatment employed consists of slow filtratiou through sand filters of fairly shallow depth (about 65 cm.), scientifically constructed and bacteriologically controlled; the water being previously charged with a coagulant. This coagulant is formed by the action of the water on metallic iron. The insoluble organic salts thus produced are not of a dangerous character for the purposes of supply, and moreover filtration completely removes them from the water. The river waters of the Paris basin having a sufficient degree of hardness, the iron employed as the coagulant gives excellent results, and allows of subsequent filtration at the rate of 4 cubic metres per square metre per 24 hours (88 gallons per square foot); that is to say, with half the filter surface required for filtration by sand only.

The water drawn from the Seine is stirred with metallic iron in rotating cylinders termed "revolvers." On leaving these, the water flows over cascades, the object of which is to peroxidize the salts of iron formed, into decanting reservoirs, where it gets rid of the greater part of the solid matter in suspension; being conveyed thence to the sand filters, and from them through conduits to the sumps of the high-lift pumps, which raise it to the reservoirs. The duration of contact between water and iron in the revolver is about $3\frac{1}{2}$ miuutes, and its sojourn in the decanting tanks three hours, during which it traverses a distance of about 300 metres through narrow channels. The filtering layers are 65 cm. thick, with a head of 90 cm. of water over them on the average. The filters act at the surface, and the materials which compose them—bricks, pebbles, gravel, sand, or porous slabs and sand—are in reality only the support of the surface layer, which alone appears really efficacious by reason of the "felting" which constitutes it.

Although the quantity of iron dissolved is small ($2\frac{1}{2}$ to 3 grammes per cubic metre), coagulable salts are formed, the influence of which is manifested in the following manner: (1) The diminution in the dissolved organic matter from the moment the water leaves the "revolvers," (2) A coagulation of the "colloidal" alumina by the "colloidal" salts of iron. (3) The production of a "felting" formed in great part by these colloidal salts of iron in the upper layers of the filters, but sufficient nevertheless to prevent the penetration of the fine clay silt, and consequently the blocking of the lower layers. (4) The progressive formation of a deposit composed of clay silt, salts of iron, and the *débris* of living organisms or micro-organisms, constituting the really active layer of which the underlying layers are only the support.

The working of a filter is constantly followed. The attendant kuows at each moment the state of each filter, its delivery, loss of head, and the number of turns or fractions of turns of the valve which controls the filtered water conduits. Daily charts of these observations are drawn up for the central office, where they are combined with the charts of the running of the engines and with indications of level in the collecting sumps, so that constant control is exercised. These measures of control allow of obtaining, in spite of the daily stopping of engines or filters, a practically constant level in the collecting sumps, though the water comes from 30 different filters at Neuilly and 34 at Choisy-le-Roi.

Every week, at varying and unexpected dates, the officials at the Laboratory of Montsouris take samples not only from an isolated filter, but also from the pumping main, and make bacteriological analyses; the samples thus collected representing the average quality of the water supplied by the installation. From a sanitary point of view, the results obtained are excellent, the cases of typhoid fever per 200,000 inhabitants having notably diminished in the suburbs, as shown by the following figures:—

	1904.	1905.	1906.
Compagnie Générale des Eaux	159	135	151
City of Paris	201	157	183
Compagnie de la Banlieue	347	230	213

Turning to the purifying arrangements of the last-named Company, we learn from the pamphlet that after a prolonged study of the best systems of filtration in Europe and America, the Company erected on the high ground surrounding their reservoir at Mont Valérien plant consisting of Puech gravel straiuers, prefilters, and finishing filters. This plant, which has a filtering capacity of 35,000 cubic metres (7,700,000 gallons) of water daily, consists of a series of Puech strainers, or "*dégrossisseurs*," which receive the river water from a small distributing basin at the head of the rising main. The strainers consist of beds of Seine gravel of graduated coarseness and of successively increasing surface contained in groups of four basins at falling levels, with provision for the aëration of the water flowing from each strainer to the one next below it. Each straiuer of the series is in four compartments, which can be independently cleaned. The first

set of strainers has a total surface of 146 square metres, with a depth of 30 cm. of pebbles measuring 20 mm. to 30 mm. on the sieve; the second set a surface of 246 square metres, with 35 cm. of pebbles of 10 mm. to 15 mm.; the third a surface of 447 square metres, with 40 cm. of pebbles of 7 mm. to 10 mm.; and the fourth a surface of 741 square metres, with 40 cm. of pebbles of 4 mm. to 7 mm. The water passes through the strainers at a high speed; the rate decreasing from approximately 180 cubic metres per square metre of surface per 24 hours in the first set to 35 cubic metres in the fourth set—allowing for one-third of the total area to be laid off for cleaning. The gravel is washed by being turned over by hand under a stream of river water; the muddy water being discharged by a waste-pipe. On leaving the strainers, the water flows on to a group of filters having a total surface of 2160 square metres in twelve equal compartments, and composed of a bed of coarse sand 60 cm. thick overlying a layer of gravel and perforated bricks. These are known as "pre-filters," and are intended to run at about 20 cubic metres per square metre.

After aëration between each of these successive operations, the water reaches the final or finishing filters, the total surface of which is 12,600 square metres, divided into 18 filters of 700 square metres each; two of them being covered and constructed under the pre-filters. The finishing filters are composed of a bed of fine Seine sand, 90 cm. thick, supported by a layer of gravel laid on a perforated brick floor; special provision being made to prevent unfiltered water passing down the walls of the filter, and to ensure a uniform rate of flow over the whole area of the filter-bed. The filtered water flows from the finishing filters to a reservoir constructed beneath them, having a total capacity of 19,000 cubic metres, and being in three compartments of unequal size.

The delivery of the strainers is regulated to suit the working of the filters, and to correspond with the increase or diminution in the quantity of water pumped from the works, of which information is given by telephone. The delivery of the pre-filters is regulated by sluice-cocks to correspond with that of the strainers; float-valves being provided to restrict this delivery to the maximum permissible for good results. The delivery of the finishing filters is controlled by a Didelon automatic regulator.

The whole of the construction is of reinforced concrete, and was carried out by the Company from the designs prepared by M. Chabal, Engineer and Technical Director for M. Puech, after consultation with M. Mesnager, the Chief of the Materials Testing Department of the City of Paris, and with other specialists on this form of construction. Owing to the unstable nature of the soil, it was necessary to ensure an equal distribution of the loads to be carried by the foundations, especially on the portions of the site occupied by the reservoirs and by the columns under the filters. The contract for the works, which required 700 tons of round iron and about 3000 tons of cement, was carried out by M. Henry, the Engineer and Contractor for Public Works. The bacteriological analyses of the water purified by a trial plant showed a reduction of 29 per cent. of organic matter, 99·94 per cent. of microbes, and an increase of 96 per cent. in the dissolved oxygen. Subsequent analyses, made at the Montsouris Laboratory, fully justify the expectations of the Company as to the advantage to public health to be obtained from this method of purifying river water.

It only remains to deal with the process employed by the Municipality of Paris for the purification of river water. It consists in filtration through sand—the system employed in many cities in Europe and America. The Municipality possess two filtering installations—one at Ivry, the other at Saint Maur. The Ivry installation comprises 35 filter-beds—16 old ones constructed in 1899, and 19 new ones put into service in 1906. The first 16 beds, each 30 metres square, have a total surface of 14,400 square metres, and the remaining 19, measuring 25 m. by 30 m., a total surface of 14,250 square metres. Of the old filter-beds, eight are preceded by decanting-tanks having a total surface of 1700 square metres; the other 27 are preceded by gravel strainers, or pre-filters, of a total surface of 4410 square metres, or one-fifth of the surface of the filters. The Saint Maur installation comprises six filter-beds, each being 40 metres square, giving a total filtering surface of 9600 square metres, and they are preceded by decanting-tanks of an area of 2100 square metres.

The filter-beds at Saint Maur and the old ones at Ivry are constructed as follows: The total depth of a filter is 2·10 metres; a double row of bricks being laid on the bottom to form drains. These bricks support first a layer of coarse washed pebbles 25 cm. thick, next a layer of finer pebbles 15 cm. thick, and then a layer of gravel 10 cm. thick. Finally, on these layers of pebbles is laid a bed of fine and very clean sand 50 cm. thick. There is thus a total mass 100 cm. deep for the filtering material and its support, over which there is a depth of water of 90 cm. In the new filters at Ivry, the idea was conceived of substituting for the pebbles and gravel, which, with the double row of drain-bricks, means a depth of 50 cm., a sort of perforated floor composed of slabs of low-grade concrete, 50 cm. square and 7 cm. thick, resting on a single row of bricks laid flat and forming drains. These slabs are sufficiently porous to allow of the easy flow of filtered water while retaining the fine sand. They are, moreover, reinforced by six rods of round iron, and easily carry the load to which they are subjected. The porous slabs and the supporting bricks only occupy a depth of 13 cm., whereas the pebbles and gravel take 50 cm. Thus by the new process the filter-bed (sand) gains 37 cm. in depth.

The speed of the filtration of water in the filters is fixed at the unvarying rate of 10 cm. per hour. That is to say, each filter can deliver 2·40 cubic metres of filtered water per square metre of surface per 24 hours (52 gallons per square foot). Automatic apparatus allows of the regulation of the delivery of each filter in a uniform and constant manner. The working of the filter-beds is placed under a special member of the staff, who determines daily, from samples drawn from each filter, whether the water is suitable, from a micrographical standpoint, for the supply of Paris. When the water of a filter is not considered sufficiently purified, it is run back to the Seine until the time when it no longer contains any *bacillus coli*.

As the result of a vote of the Municipal Council, a competition of systems of sterilizing water has also been installed at the Saint Maur works. Each inventor has set up a trial plant on the site of the works. The plants are: (1) Société d'Épuration d'Eau (Desrumaux's sulphate of alumina system). (2) Société de Stérilization des Eaux (Otto's ozone system). (3) Société Industrielle de l'Ozone (Marmier and Abraham's system). (4) Procédé Howatson (chemical process by "ferro-chlore").

NEW RESERVOIRS AT HONOR OAK.

An interesting visit was made by the members of the Society of Engineers, a fortnight ago, to the new reservoirs of the Metropolitan Water Board, at present in course of construction at Honor Oak. They will contain nearly 60 million gallons of water, and will probably be the largest covered reservoirs in the world. The construction generally is of brickwork and concrete, with division walls separating the reservoir into four divisions. The longitudinal centre wall runs approximately north and south; so for the purpose of reference the reservoirs will be known as the north-east, north-west, south-east, and south-west.

The outside walls of those portions of the south-east and south-west reservoirs which are below or level with the natural ground represent in plan a series of flat arches so as to resist earth pressure. The north-east and north-west reservoirs have concrete retaining walls, faced with brickwork. The centre dividing walls are also arched in plan, and are practically double walls filled in between with concrete; the thickness varying from 6 feet in the centre of each bay to 10 feet at each buttress.

Around all the outer walls and the division walls, buttresses in brickwork project into the reservoirs. These buttresses are carried up solid to the drums on the roof covering, and in themselves form substantial counterforts to the walls. The floor of the reservoir is of concrete; and its surface will be formed with curved inverts groined so as to form bases from which the brick piers carrying the roof will rise. This inverted floor will be finished with $\frac{3}{4}$ inch of cement rendering to a smooth polished face, with a drain down the middle of the invert, draining into the collecting chaunel.

From each base a brick pier is built, which is continued up 14 feet, where jack-arches are turned, connecting each pier north aud south. From the top of the wall thus formed, the drums or covering arches spring. The drums form a series of tunnels running north and south. The haunches of the arches are filled with concrete, on the top of which clay puddle will be placed, followed with earth and finally soil. A drain with open joiuts is laid on the surface of the puddle for the purpose of draining the top of the reservoir. A puddle wall 3 feet thick extends all round the outer walls, and is keyed into the clay—thus making the work watertight.

At the centre of the four reservoirs where the division walls intersect will be the central well, from which the charging and emptying will be directed. All the opeuing valves—42, 36, and 30 inch—will be arranged round the well, and worked by means of headstocks from a gallery running round the well. By means of special connections, it will be possible to work each or every reservoir at the same time, without interfering with the others. Above the central valve well will be a valve-house, in which the electrical recording indicators will be arrauged. When the works are completed, the tops of the reservoirs and the slopes will be soiled and sown with grass seed.

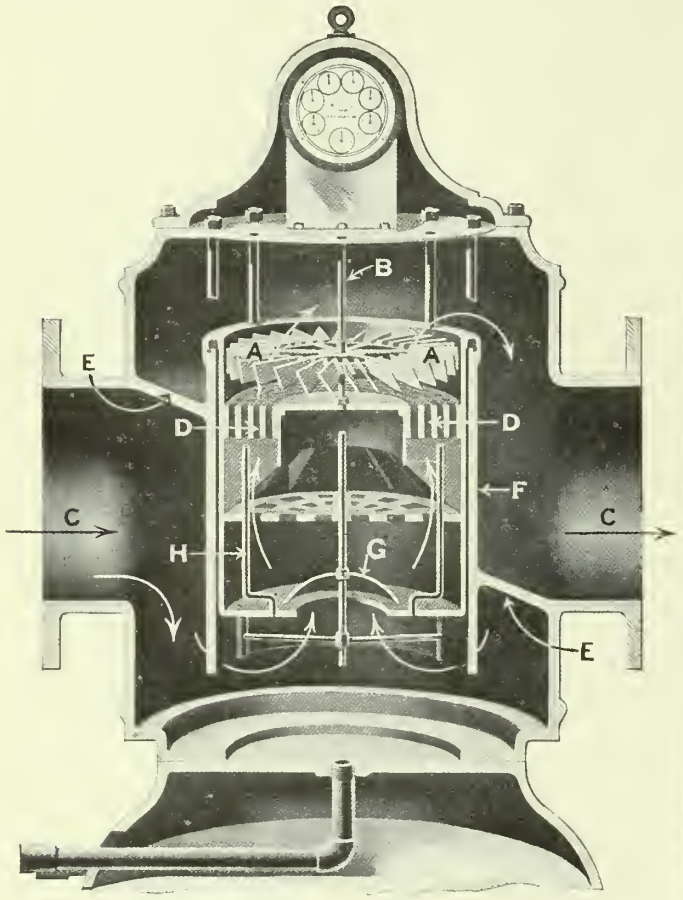
The bricks used in the construction of the reservoirs have all been manufactured by the Southwark and Vauxhall Water Company first, and later by the Metropolitan Water Board, from the excavation. Not only has the material been utilized in the makiug of the bricks, but the ground has been excavated on the site of the reservoir—thus reducing the quantity of earth to be handled by the contractor. It will be seen that the works involve the use of a large amount of concrete, in the production of which four of Taylor's one-yard concrete mixers are engaged. In these mixers each charge of material is measured and mixed separately, and each of the machines employed will mix 24 cubic yards of concrete per hour.

The whole of the works were designed by Mr. J. W. Restler, M.Inst.C.E., the Engineer to the Water Company, and now the Deputy Chief Engineer to the Water Board; and they are being carried out, under his direction and supervision, by Messrs. J. Moran and Son. The estimated cost of the works, including pipes and valves, but exclusive of land, is approximately £170,000.

The report of the proceedings of the Scottish Junior Gas Association (Eastern District), reprinted from the "JOURNAL," has been issued. The pamphlet extends to 40 pages. In addition to the papers and reports of the discussions, lists are given of the office-bearers and members.

THE ROTARY METER.

This meter, which has now for some time been well known in England, was introduced to the notice of French gas engineers and managers at the meeting of the Société Technique at Nancy. M. Chamon, of the Cie. pour la Fabrication des Compteurs, &c. of Paris, read a short paper descriptive of the meter, a clear illustration of which was given, which is herewith reproduced, together with an abstract translation of the paper.



For a long time past the gas industry has felt the need of measuring large volumes of gas with apparatus rather less bulky and less costly than the type of station meter actually in use. The "Duplex" meter, with two drums on the same axle, to some extent met this demand; but even these meters are too big when it is required to measure the output from large gas-works. The point has again arisen in connection with the utilization of gas coming from coke-ovens and producers. Such gases are really bye-products, and are sold at very low prices—proportionate to their calorific power. The cost and dimensions of apparatus measuring such gases must be reduced to the greatest extent possible. Messrs. Thorp and Marsh's rotary meter fully meets these requirements. It is of small size, taking up one-tenth of the room occupied by the old type of meters by volume for a corresponding hourly capacity.

It consists of a cast-iron body mounted on a stand, with pipe connections C and flanges. The inlet and outlet are separated by an inclined division E connected to the central cylinder F. The whole is surmounted by a cast-iron cover, which contains the dial mechanism. The moveable parts consist principally of a winged wheel A, the wings of which are at 45 degrees, and are mounted on a central shaft B, working so as to reduce loss and wear to a minimum. The shaft is provided at its top with an endless screw actuating the dials. A group of tubes D, placed immediately below the winged wheel, directs the gas from bottom to top. A light valve G preveuts the gas from going back; although its principal object is to force small quantities of gas through the tube. It is obvious that as soon as the loss of pressure corresponding to a given quantity is less than the weight of the valve G, this latter will close, and the gas will be obliged to pass by the tube H. It is thus that the required degree of correctness can be obtained up to 10 per cent. of the normal output. This result, which from the point of view of accuracy must be considered extremely satisfactory, has been achieved by the combination of the parts described. The sensitiveness of the apparatus remaining the same, the meter is as exact when new as it is after a long period of use. It contains no part that can be deteriorated by the gas. Such meters are practically independent of the specific gravity of the gases; and they can be used whether the gas is purified or not. In works where coal gas and water gas are made at the same time, it is useful to measure separately the water gas; and the rotary meter offers a cheap means of doing it. It can also be used for measuring the air required for the revivification of purifying material. It was, indeed, for this purpose that the first four meters of 300 cubic metres (10,595 cubic feet) per hour were supplied to the East Greenwich works of the South Metropolitan Gas Company.

Rotary meters are very useful for measuring gas at high pressure, or natural gas, &c.; and they are as correct at a high as at a low pressure. Special apparatus for high pressures, to withstand 10 atmospheres, can be used where ordinary meters could not be adopted. As regards high pressures, it may be remarked that, the volumes being inversely as the pressures, a special arrangement is necessary to correct the record of the amount of gas passing at different pressures. With this object, the apparatus is provided with a special differential arrangement, which gives the results corresponding to the volume at atmospheric pressure. The meter with this automatic arrangement is correct at all pressures. For example, a volume of 100 cubic metres, at atmospheric pressure, passing through an ordinary meter at 4 kilos. pressure, would be indicated by the dials as only 25 cubic metres, the volume having been reduced to one-fourth by compression. With the differential device referred to, the amount registered would be 100 cubic metres, and so on for all pressures; it being understood that the temperature remains the same.

A NEW DIRECT-READING PYROMETER.

In our "Register of Patents" for June 18 (p. 819), we gave a description and sketch of a pyrometer designed by M. Féry. This apparatus, which promises to be of some utility, was the subject of a paper by M. Verdier at the Nancy Congress of the Société Technique; and we give the following translation of it.

To ascertain the temperature of retort-settings is an important point in managing them; and all engineers of gas-works are convinced of their interest in having simple and correct means of measurement of temperature. A great number of appliances, based on different principles, have been brought out—Seger watches, Nouel glasses, the thermo-electric couple of Le Chatelier, the Wanner pyrometer, and Féry's telescopic pyrometer, &c. The number of the solutions proposed shows that no one of them is absolutely satisfactory. The Seger watches require long and delicate handling, and only give relative indications of temperature. Besides this, they do not easily allow of measurements being taken at any point of the setting. The Nouel glasses are wanting in precision; the results varying between one operator and another. The pyrometer of Le Chatelier was the first practical apparatus to allow of exact measurements being taken; but it required a special installation, was costly, and its most serious defect was that it varied after being in use, which necessitated its frequent verification. It could only be graduated in a well-equipped laboratory. In the Wanner pyrometer, the red radiation of the furnace under investigation was compared with the same radiation from an incandescent lamp. The latter had to be frequently corrected by reference to a standard of amylacetate. Féry's pyrometer, which was described at the 1904 Congress of the Société Technique,* marked a notable advance. The graduated apparatus had not to be compared to other appliances; and it could be put into the hands of a foreman, as it only required a little care in manipulation and in the management of its galvanometer, which gave direct readings of the temperatures observed. This galvanometer, however, was a delicate apparatus.

The new solution offered by M. Féry overcomes this objection. It is as simple as possible, requires no galvanometer, and can be entrusted to anybody. It consists essentially of a strip formed of three superimposed metals—silver, gold, and platinum. This strip is about 2 mm. wide, and 2·10oths to 3·10oths of a millimetre thick. The length of the strip is 12 mm., and it is twisted into spiral form—its largest diameter being about 1·5 mm. This spiral is placed in the focus of a spherical surface, receiving the calorific radiations of the body of which it is desired to ascertain the temperature. The heat radiated by the mouth of a furnace is, according to the law of Stéfan, proportional to the fourth power of the temperature of this furnace. In accordance with the well-known properties of bimetallic strips, as soon as ever the spiral receives the calorific rays, it winds or unwinds, owing to unequal expansion, according to the order in which the metals composing it are placed. In practice, the metals are arranged so that the spiral will open. It plays the part of a thermometer; presenting, however, this peculiarity—that its sensibility is greater as the mass is smaller, which is the opposite of expanding thermometers. The smallness of the spiral enables equilibrium to be very rapidly reached, and the spiral in a few seconds takes up the position corresponding to the temperature observed.

To the spiral is fixed a needle working on an indicator or dial. Reading off from this gives the temperature required. Each deflection corresponds to a temperature shown on the indicator. The apparatus is graduated once for all. Before each operation, it is advisable to put the needle back to zero on the indicator, by a screw fitted for this purpose. The indicator is arranged for a series of temperatures from 600° to 1400° C. The apparatus is also provided with an accessory arrangement for automatic starting, allowing of the concentration of the rays on the spiral. The measurement of the temperature is thus made independent of the

* See "JOURNAL," Vol. LXXXVII., p. 31.

distance of the apparatus from the furnace, which is an essential condition for simplicity of observation.

The method of using the apparatus is very simple. All that is required is to open one of the sight-holes of the bed, and to direct the apparatus at the point of which the temperature is required, whether in the nostrils or under the arch of the bed, or even in the inside of the retorts. This can be done without being obliged to go too near; one may be 3 or 4 metres (about 10 feet) away. From tests made with the apparatus, it is found to be exactly comparable to itself. The temperature of the spiral only goes up a few tens of degrees in order to measure temperatures of 1200° to 1400° C.; and the inalterability of the metals forming it is absolute. The pyrometer has, moreover, been admitted to official stamping by the Conservatoire des Arts et Métiers. The solution of measuring temperatures by this apparatus appears to be excellent under all conditions; and it may be of great usefulness in gas-works, owing to its simplicity, which allows of its being placed in the hands of anyone.

METHODS OF INCREASING COKE SALES.

In our review of the proceedings of the annual meeting of the French Gas Society, it will be remembered that it was recorded that the President's Address was almost entirely taken up with the question of ways and means of developing the sales of coke. At his request, also, M. Sar contributed to the proceedings a paper on the subject, of which the following is a summary.

The sale of coke has become more and more difficult, either on account of the competition of other fuels, or by the extended use of electricity for motive purposes. The gas industry ought, therefore, to make a special effort to develop the use of coke as a fuel wherever it can be advantageously adopted. Notwithstanding a previous disposition on the part of the military authorities in France to regard coke as a "*combustible de luxe*," and as taking longer than coal to cook the same amount of food in the military ovens, yet "it may be that, owing to local circumstances, the price of coke will allow of its being used with advantage, and the previous remarks will not apply." (Bulletin Officiel du Ministère de la Guerre, article 56.) Two outlets for coke are especially noticed by M. Sar. The first is the use of coke for producers for poor gas; the second is the adoption of coke by bakers.

As regards coke in poor-gas producers, with anthracite at 45 frs. per (metric) ton, and coal and coke at 35 frs. per ton, the following results are arrived at:—

Fuel.	Ash.	Cost per Horse-Power.	
		In Fuel.	In Money.
Anthracite	7 per cent.	425 grammes	2 centimes
Coal.	12 ,,	550 ,,	2 ,,
Coke	10 ,,	550 ,,	2 ,,

In many cases, coke is preferred as a fuel owing to the certainty of its supply.

M. Sar then deals in some detail with the adoption of coke for bakers' ovens; and he also describes an electrically driven kneading machine. But both these points are of more particular interest and application to the South of France, and therefore need not be further mentioned in our columns. The general lesson, however, that may be profited by is that there are a great variety of ways in which coke sales can be pushed, if intelligent and energetic investigation be applied thereto.

USE OF TAR FOR ROAD MAINTENANCE.

At a recent Meeting of the Association of Municipal and County Engineers, held in St. Andrews, Mr. Thomas Aitken, M.Inst.C.E., the County Road Surveyor of Cupar, read a paper on "The Construction and Maintenance of Roads," in the course of which he made the following remarks on the use of tar.

The application of tar to macadamized roads has occupied the author's attention for many years; and various methods of applying it have been tried, with, generally speaking, beneficial results, but in a manner and at a cost which would not warrant its general introduction. Further consideration of the matter showed that if tar could be applied in the form of a fine spray in recoating operations, the object aimed at would likely be attained. By such means, the ordinary method of applying water and some form of earthy binding material would be dispensed with, and a practically waterproof road formed, which would reduce mud and dust to a minimum. The results of these experiments, favourable in most particulars, led the author to devise an apparatus for spraying tar, either in a hot or a cold state, into the newly-spread coating, so as to act as a matrix or binder, instead of using water and a binding material.

In working the apparatus, it is necessary in the first place to pump air into the receiver to a pressure of from 100 to 150 lbs. per square inch, depending on the viscosity of the tar, before forcing the tar into it from the tank. In order to obtain this pressure, it is necessary to run the vehicle for some time along the road, or it may be accomplished by lifting the wheels clear of the ground, and attaching a driving-belt to a road-roller or traction-engine. Once the necessary pressure is attained, it remains constant, and the machine is at all times ready for working; and when the desired pressure is registered, the valve is adjusted so as to pump in tar, or tar and air, from the tank into the receiver. When the latter is about half-filled with tar, the pressure will rise to from 200 lbs. to 250 lbs. per square inch, when the apparatus is ready for spraying the tar. The outlet-valve may be regulated to give an exceedingly fine spray, or a larger quantity may be applied by opening it to three-quarters or full cock. The supply-regulating valve must be so adjusted that the quantity of tar pumped into the receiver will equal the amount of tar being sprayed on to the road. The metalling is not rolled in the first instance, as in the ordinary system of consolidating the material; the object being to cover all the surfaces of the roadstone with a film of tar previous to consolidation. This is carried out by passing the spraying-machine over the loose metal once in either direction, which, combined with the great pressure exerted in forcing the tar through fine spraying nipples, ensures the whole mass of stones, to a depth varying from 3 to 5 inches, being equally treated. The fineness of the spray secures equal distribution, and the pressure forces it well into the metal coating. After a length of from 30 to 50 yards of full-width coating has been sprayed with tar, a light layer of small chips is applied, to assist in filling the interstices, especially at the surface.

The amount of tar necessary to properly coat the roadstones for every ton of metal applied, varies according to the size of the material used and the quality of the tar; but from four to six gallons may be considered quite sufficient under ordinary circumstances. This quantity of tar would, therefore, with a 3½-inch coat of metal, be equal to 0·56 of a gallon per square yard of road covered. The initial cost of making roads by this system is greater than by the ordinary method. The material after consolidation, however, becomes a homogeneous mass, and internal friction or abrasion is eliminated. The prolongation of the durability of a road so made will be greater—probably doubled—compared with the ordinary method of construction; and consequently ultimate economy is promoted. The surface of a tarred road is practically waterproof, and the elimination of dust and mud, or their reduction to a minimum, would alone be sufficient to justify the general application of tarred macadam.

The cost per day of carrying out the work in the manner described for consolidating 130 tons of metal each day is 13·46d. per ton. The additional cost was 6d. to 8d. per ton more than ordinary macadam. The cost of tarring and rolling a 3½-inch coat of metal is 1·5d. per square yard. On a road 16 feet in width, the additional cost by using tar would be £26·08 per mile over the ordinary method when water is obtained free of charge. On a similar road, but using 6 gallons of tar per ton of metal applied, instead of 5 gallons, the cost would be £35·16 per mile more than consolidating macadam in the ordinary way. The amount of water required per ton of metal by the usual methods of consolidation is about 40 gallons; and when this has to be paid for, the cost may be taken at 2s. 3d. per day. The cost of tar varies considerably in different localities. But the quality is of the greatest importance; and only the best distilled descriptions should be used. The best form of vehicle for spraying the tar is a motor-van having large tank capacity, holding about 800 gallons, which would be more than sufficient for one day's work.

The results of the method of construction or repairing roads described show that the road during and after the trying climatic conditions of alternate frost and thaw presents a smooth compact surface. The "licking-up" of the roadstones by the wheels of vehicles under such conditions on ordinary macadam is very great, and considerable damage is thereby caused. On the tar-macadamized roads, however, experience shows that "licking-up" does not take place under these circumstances; consequently economy is promoted by the reduced cost of maintenance. The method of flushing the tar over the surface or grouting requires from 7 to 9 gallons of tar for each ton of roadstones applied. This quantity is, however, excessive; and it may become sticky and troublesome in hot weather, and may lead to the disintegration of the surface. It is essential that the road metal, chips, and dust should be in a thoroughly dry state, as moisture militates against good work; therefore rolling operations by this process can only be undertaken in fine weather. The finished surface is like asphalt in appearance; and while not quite equal to it in actual wear, it has superior properties in some respects. The macadamized road has a certain amount of resilience; foothold is much better; and it is practically noiseless compared with an asphalt pavement.

The reason why tarred macadam, carried out in a proper manner, is free from dust and mud and wears longer than the ordinary macadam, is simply because the frictional resistance of the stones is increased to such an extent that internal motion and rubbing are prevented, and the tar and chips which fill the interstices of the metal coating prevent percolation of water and the evils resulting from this cause. Tar, no doubt, might be improved by the addition of a bituminous material, which would further increase the life of a road, but, of course, at additional cost.

DURABILITY OF REINFORCED CONCRETE.

At the recent Engineering Conference, the subject of the durability of structures in reinforced concrete was brought forward in two communications in the Harbours, Docks, and Canals Section.

Mr. F. E. Wentworth-Shields opened his paper by expressing the opinion that probably one of the principal reasons why English engineers have hitherto hesitated to introduce reinforced or steel concrete is that it is difficult to speak with certainty about its durability. Only fifty years have elapsed since Monier first used it, and only about ten years since it was employed on any scale in this country. Consequently it is not yet possible to point to any work in steel concrete which has stood the test of centuries; and all we can do is to look at existing structures, and notice carefully how far they have suffered, and what repairs have been necessary. In so doing, we can not only form an idea whether steel concrete is likely to be long lived, but also as to what precautions are necessary when designing to render it so.

The chief things which we should expect to shorten the life of reinforced concrete are: (1) Settlement of foundations; (2) fire and earthquake; (3) atmospheric change—rust, &c.; and (4) abrasion and collision.

Dealing first with settlement of foundations, the author pointed out that steel concrete is a rigid material, and the foundations of a structure of this substance ought to be designed in such a way that they cannot settle. This can always be done, even on soft ground, either by piling or by spreading the weight over a large area on a strong reinforced concrete base. An instance of the evil of neglecting this precaution was to be seen at the Kom Ombo pumping-station in Upper Egypt last year. A culvert of reinforced concrete, 10 feet in diameter, was laid in the Nile silt. The ground had evidently been disturbed beneath it, and the culvert settled down, producing transverse cracks in the concrete. The water escaping from these cracks no doubt aggravated the settlement; and by the time the culvert came to rest, the leakage of water was so serious as to necessitate its being abandoned.

Passing to the effect of fire and earthquake on reinforced concrete, the author said the material was undoubtedly highly fire-resisting. Many experiments had been made to test this; but perhaps one of the most striking proofs is the fire which occurred a few years ago in a warehouse in Baltimore. Not only were the contents of the building destroyed, but its brick walls almost entirely collapsed; the floors, however, which were of concrete reinforced on the Hennebique system, and supported on steel concrete columns, remained intact. With reference to damage by earthquake, Captain Sewell has given an excellent account of the behaviour of reinforced concrete at the San Francisco earthquake. He mentions the museum building at the Leland Stanford University, which had three wings—one of reinforced concrete and two of brickwork. One building received a very severe shaking, and while the brick wings were in a state of collapse, the damage to the steel concrete wing was insignificant.

With regard to atmospheric changes, the author said we have had enough experience of concrete to know that, if good, it is practically unaffected by atmospheric changes. At one time it was feared that the steel might rust, especially in structures under water; but this fear seems to be groundless. Some recent experiments on the permeability of concrete by Mr. Baldwin Wiseman show that, if well made, it is one of the most water-tight materials known, and that it rapidly becomes less and less porous when water is forced through it. Some experiments recently communicated to the American Institute of Electrical Engineers raised the alarm that steel rods immersed in damp concrete rust rapidly when mild electric currents are passed through them. To this the best answer is that well-made concrete should not be, and generally is not, damp. However, the author said the risk should not be overlooked, and care should be taken to exclude electric currents from steel concrete work as much as possible.

Coming to the effect of abrasion and collision, the author said it had been stated that steel concrete has far more resistance than timber to abrasion from shipping or other floating objects. His experience at Southampton, however, convinced him that this was quite exaggerated praise. On the contrary, if reinforced concrete was to be used for marine work, it must be carefully fendered at all parts where it was likely to be struck. In most systems of reinforced concrete the steel is placed within only an inch or two of the surface, and if the structure is not protected by timber cushions, this concrete skin is easily knocked away, leaving the steel naked and liable to rust. The author stated that the coaling-jetty at Southampton (completed 2½ years ago) suffers as much, perhaps, from the blows of ships and barges as any steel concrete structure yet made. It is protected by fenders of American elm; and in spite of blows which have caused the whole jetty to sway, there is no sign as yet of the concrete spalling off, except at one or two places where the blow has fallen direct on the concrete.

In conclusion, he thought that, on the whole, it might be said that our experience goes to prove that reinforced concrete, if well designed, is likely to be one of the most durable building materials—if not the most durable—that can be found.

The other paper was entitled "Ferro-Concrete Structures;" the author being Mr. C. Scott Meik. At the outset, he assumed that the method of constructing ferro-concrete was understood by all engineers, and therefore he merely drew attention to certain points in connection with its manufacture which should be specially attended to. His experience of the construction and durability of ferro-concrete was gained chiefly in connection with piers and wharves, particularly a pier at Purfleet on the Thames, built for the purpose of discharging coal from steamers into craft in the river or waggons on the pier, and the reconstruction of a pier in Italy.

The Purfleet pier is supported on piles 14 inches square, driven from 15 to 18 feet into the river bed, and well braced together, the decking consisting of ferro-concrete, 5 inches thick, covered with 2½ inches of tarred gravel paving. The piles were made on shore, and driven from a timber staging, and were each from 40 to 45 feet in length. The approach from the shore to the pier was constructed partly on piles 14 inches square and partly on columns 5 feet in diameter; the former being used at the shore end, and the latter below low-water line, in order to allow of larger spans being used for the passage of barges and boats. Between the pier proper and the approach to it, is a bridge of about 60 feet span, consisting of ferro-concrete bow-string girders and flooring. The pier has to carry four transporter cranes, each weighing upwards of 80 tons; the maximum downward pressure on any one pile being about 25 tons.

The form of the section of bars, provided the area is sufficient, is of little moment; the friction of the steel in the concrete varying but slightly in all cases. A little rust on the bars is no objection, as it increases the friction. The round bar offers most facility for getting the steel thoroughly embedded in the concrete. The stirrups, or iron bands for holding the round steel bars in place, must be so formed as not to give until the limit of elasticity has been reached. At Purfleet those first used stretched, owing to not being efficiently connected; and under test a section of pile crushed prematurely, because of the round steel bars buckling outwards at the centre. The object of the use of the stirrups is to prevent this. The test-piece referred to was part of a 14-inch pile, 5 feet in length, which crushed under a stress of 221 tons, or 1·13 tons per square inch. An improved form of stirrup was subsequently used, which increased the strength of the pile or column to a large extent. The round bars in the framework of the pile must also be efficiently strutted by diagonals to hold it rigid until the concrete mass has set hard in and around the framework of steel.

It is necessary to crush the aggregates of the concrete small enough to pass through a mesh of ¾ inch diameter, in order to permit the concrete to get into all the interstices of the steel framework; and to ensure this the concrete should be well rammed in with suitably shaped rammers. The ramming of the concrete does not have much effect on its strength after it has been made for twelve months. Experiments of blocks 12-inch cube prove this. A cube of 12 inches of rammed 4 to 1 concrete edge crushed at 265 tons, or 1·84 tons per square inch; and a similar cube of 4 to 1 concrete made in the ordinary manner failed at 258 tons, or 1·80 tons per square inch. Both blocks were 18 months old at the time of testing. The ratio of cement to aggregates should be 6 to 1 for ordinary beams and floors, and 4 to 1 for piles and columns to carry heavy weights. In the upper end of piles, for a length of 1 foot, it should be 3 to 1.

The author's experience, so far as it extends, proves that the deterioration of the steel in the concrete, provided the latter is properly made, is a negligible quantity. Numerous rust-marks have appeared on the piles in the pier at Purfleet since its construction; but the greater number of these are due to nails accidentally mixed in the concrete, and embedded in it close to the surface. In the few cases where the water has gained access to the steel bars, there has been no difficulty in cutting out the defective concrete and making good with cement. A pile end, which had been in the sea for eight years at Southampton, was lately on view at Paddington Station. The exposed steelwork on this specimen was much corroded; whereas the bars in the body of the concrete, on being cut open, were found to be quite free from any rust, and as fresh as on the day they were put into the pile.

Coming to the question of cost, the author said that at Purfleet the piles cost about 5s. 6d. per cubic foot, bracings about 5s. per cubic foot, and the decking was 20s. per square yard. The cost of the pier proper on which the cranes are placed worked out to 17s. 8d. per square foot of surface, and that of the pier approach to 10s. 2d. per square foot. He added that these prices were on the high side, owing to the great height from the decking to the points of the piles—as much as 70 feet in some instances—and also to the fact that the pier was designed to carry very heavy loads. On the other hand, the price for piles was low if the difficulty of driving them into the compact Thames ballast is taken into account.

In Mr. Meik's opinion, ferro-concrete is to be preferred to timber for marine structures, as it is immune to the attacks of the sea-worm. On the other hand, timber is easier to repair when damaged by collision. As regards cost, ferro-concrete is about the same price as green-heart timber; while it is about 1s. to 2s. per cubic foot dearer than pitch-pine at its present price. As to structures on land, ferro-concrete is preferable to timber, as it is absolutely fireproof, and can be made as strong as steel in building and stagings, provided weight is not an objection. For large buildings, it works out cheaper than stone, and is much lighter—a consideration when the foundations are defective.

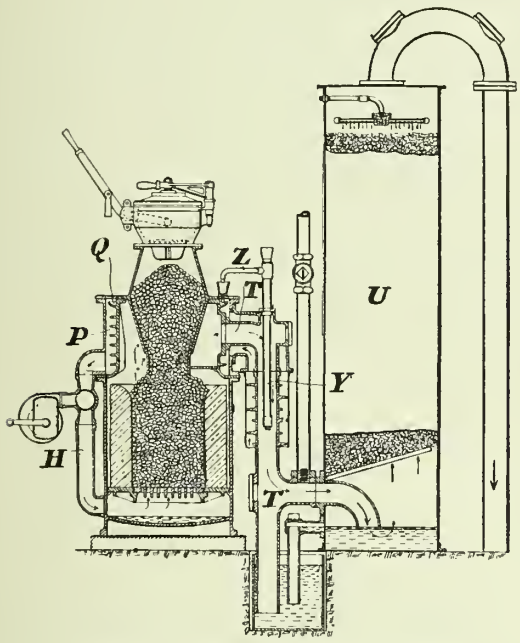
REGISTER OF PATENTS.

Suction Gas Producing Plant.

Bickerton, H. N., Robson, P. W., and the National Gas-Engine Company, Limited, of Ashton-under-Lyne.

No. 13,703; June 14, 1906.

In suction gas producers as at present constructed, the patentees remark, it is usual to provide around a hot portion of the producer a vaporizing chamber through which the air supply is drawn and into which water is delivered for supplying the requisite steam for the producer. In the "best practice" hitherto, this vaporizing chamber has been filled with material—metallic turnings or the like—to increase the evaporative surface. It is found, however, that after awhile the chamber becomes more or less choked or locally channelled (especially where hard or impure water is used); and it becomes necessary to clear out the chamber and renew the turnings. With producers as hitherto constructed, however, this cleansing and renewal has been a difficult matter—involving the dismantling of the producer and the breaking and remaking of jointing which must be kept air-tight in operation.



Bickerton and Robson's Suction-Gas Plant.

The primary objects of the present invention are to provide a suction producer with an improved vaporizing chamber, which may be easily opened up or removed without breaking any of the principal joints of the producer, and to provide large evaporative surface of a character which shall not become choked or locally channelled when used for long periods, even with hard water. Further objects are to provide improved air and feed-water devices and an improved air-supply arrangement for use in starting the apparatus.

The producer is made with a lower body portion consisting of one or more cylindrical parts having at the top a flange, to which an upper flanged portion of the producer is secured by a tight and permanent joint The upper portion is preferably of smaller diameter than the lower. The top of the upper portion has a flange which supports a coal-container; a tight and permanent joint being made at this flange also. A coal-feed regulating device is mounted upon the top of the coal-container. A refractory lining is carried by the lower part of the producer above a closed ashpit.

Around the upper portion of the producer there is placed a circular casing, the top of which carries a flange, upon which may be secured a circular plate extending across the top of the vaporizing chamber P, which is formed by this casing and the top portion of the producer. By disconnecting the bottom of the casing from the producer, it may be removed without breaking any of the main joints of the plant.

Near the top of the upper portion of the producer is a trough extending horizontally around the apparatus and projecting into the vaporizing chamber. Water to be vaporized is delivered to this trough, the edge of which is provided with a number of V grooves, through which the water overflows. Below the trough is a series of horizontal ribs, extending around the producer, each rib being of somewhat greater width than the one next above it, whereby the water trickling down the side of the upper portion of the producer is spread out and prevented from dripping through more than a short distance. The interior of the upper portion of the producer is provided with vertical ribs, which serve to strengthen this part of the producer as well as to extract from the gases heat for transference to the vaporizer.

By their invention the patentees claim to be able to avoid the difficulties met with in vaporizers which employ turnings or other porous filling, and to obtain one which is capable "of almost instantaneously raising the steam required for gas making; the ability of the plant to quickly respond to fluctuations of load being greatly increased by the fact that there is practically no reserve of water contained in the vaporizer as is done in other producers."

The gas outlet pipe T from the producer is passed on its way to the scrubber U concentrically through an air-conduit, which opens into the vaporizing chamber around the gas outlet. The exterior of the outlet pipe is provided with ribs, which are preferably arranged spirally, so that the air is highly heated before it enters the vaporizer, on account of the long path of contact with the hot walls of the outlet pipe. It is important that the air shall be considerably preheated, in order that it may carry the requisite amount of steam into the fire. By these means the necessary heat is obtained from the outflowing gases passing to the scrubber.

The feed water is heated also by the outflowing gases. This is effected by inserting through a stuffing-box in the outlet pipe a tube Y, closed at the inner end, into which is inserted a pipe of smaller bore—after the manner of the well-known "Field" tubes in certain water-tube boilers. The hot feed water is withdrawn by a pipe Z at the top of the "Field" tube and delivered to a mouthpiece communicating with the trough Q of the vaporizer.

A fan is connected to the generator in a manner which greatly increases the facility and convenience of starting the plant—*i.e.*, the outlet branch of the fan is united to a junction on the pipe which conveys air and steam from the vaporizer to the ashpit. In this junction piece is a deflector, which may be placed so as to shut off the vaporizer from the ashpit and establish communication between the fan and the ashpit, or to shut off the fan and establish communication between the vaporizer and the ashpit. By this means the usual cocks and blank plates such as are adapted in most existing plant are dispensed with.

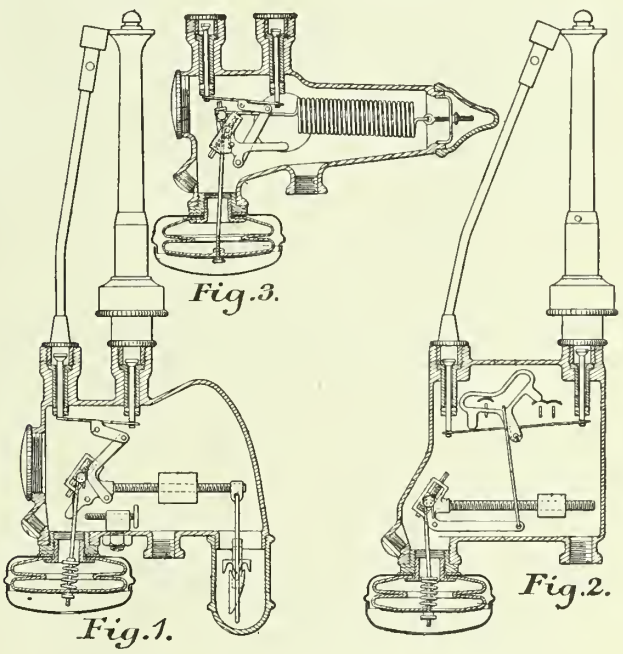
Lighting and Extinguishing Gas-Lamps from a Distance.

Elton, E. H., and Stephens, R., of Clevedon.

No. 15,067; July 2, 1906.

This invention relates to apparatus to be used in connection particularly with street-lamps—for lighting and extinguishing them from a distance by variation of pressure in the mains.

The lamps are each provided with a pilot light for lighting the main burner; and there is in the pipe or passage by which the gas from the main communicates with the burner a closed chamber, containing (or in communication with) a bellows or flexible diaphragm in or on which the gas pressure admitted to the chamber acts, and through it and through a weighted lever, or system of levers, causes a valve or valves to be operated so as to admit gas, and cut off the supply of gas alternately, to the main burner and to the pilot light of the lamp. The valves are so arranged and operated that when the main burner is alight the pilot light is extinguished, and *vice versâ*.



Elton and Stephens Gas-Lamp Lighter and Extinguisher.

The valves, according to one arrangement, are connected to, or are acted on by, a lever connected by an arm and link to another lever, which also works on a fulcrum within the closed chamber and is provided at its free end with an adjustable weight; or in conjunction with the lever a spring may be employed by means of which the pressure of gas required to operate the valves can be regulated as desired. This lever is connected to the bellows or flexible diaphragm by an adjustable screw connection; and according to the distance this connection is from the fulcrum of the lever, so will depend the pressure required to operate the valves to effect the lighting and extinguishing of the lamp burners or vary the difference of pressure required for lighting and extinguishing them. The adjustment of the connection of the bellows to the lever to which the valves are connected can be effected by screw and nut arrangement carried by the lever; and instead of an adjustable weight or spring, the lever may be provided with a screw adjustment to vary the pressure required to operate the valves.

A separate valve may be provided for each of the passages to the main burner and to the pilot light, or a single valve of suitable construction may be provided for governing the two passages in such manner that when the pressure on the main rises to a predetermined point the gas will be admitted to the main burner, and when it is reduced below it the supply of gas to the main burner will be cut off.

If one main burner is to be lighted at high pressure and retained alight while the low pressure is extinguished the other main burners and eventually to extinguish the single main burner at low pressure preceded by a temporary high pressure, there may be loosely hung from the lever to which the bellows is attached a swinging arm, the lower end of which is arranged to engage a fixed catch or projection.

This arm is provided for the purpose of retaining the burner alight when the gas pressure is reduced—for example, when the pressure increases the bellows will raise the arm so that its lower end will slide up an inclined surface of the fixed catch to above the upper end of it. Then if the pressure is reduced, the lower end of the arm will descend into contact with the upper surface of the fixed catch, and thereby keep the valve in the passage communicating with the main burner open. Then to extinguish the light the pressure is again raised, thereby raising the arm, which will then swing and pass off the top surface of the fixed catch, so that when pressure is again reduced the arm will descend, together with the lever, below the fixed catch, and thereby close the valve leading to the main burner and open the valve of the passage leading to the pilot light.

The fixed catch may be provided with a number of stops in different positions, so that any one of a number of lamps, or one series of lamps, can be lighted and extinguished separately.

Instead of making the arm to swing on the lever, it may be rigidly connected to the lever and the catch be made moveable; and instead of connecting the valves to the lever to which the bellows or diaphragm is attached, they may be connected to a rocking lever, having inclined slots or a double inclined slot in it—one inclined slot being arranged on each side of the fulcrum of the lever. In them enters a projection from an arm or link pivoted to the lever connected to the bellows or diaphragm, so that the lamp can be both lighted and extinguished at high pressure, and the slotted lever can be provided or combined with catches or stops for the projection on the pivoted arm or link to engage with. In this way, any one of a number of lamps, or the lamps of any area of a number of areas of lamps, or one or more lamps of a cluster of lamps, can be separately lighted or extinguished.

Fig. 1 represents in sectional elevation the general construction and arrangement of one form of the apparatus as applied to a single lamp, the main burner of which is caused to be lighted by high pressure of gas and extinguished by low pressure. In conjunction with it are shown means for retaining the main burner of the lamp alight while other main burners are caused to be extinguished—the first-named main burner being eventually caused to be extinguished by a temporary high pressure and a subsequent low pressure of gas.

Fig. 2 illustrates an arrangement adapted both to light and extinguish the main burner of the lamp by temporary high pressures of the gas. In combination therewith are shown stops and guards whereby any one of a number of lamps, or the lamps of any area of a number of areas of lamps, or one or more lamps of a cluster of lamps can be separately lighted or extinguished.

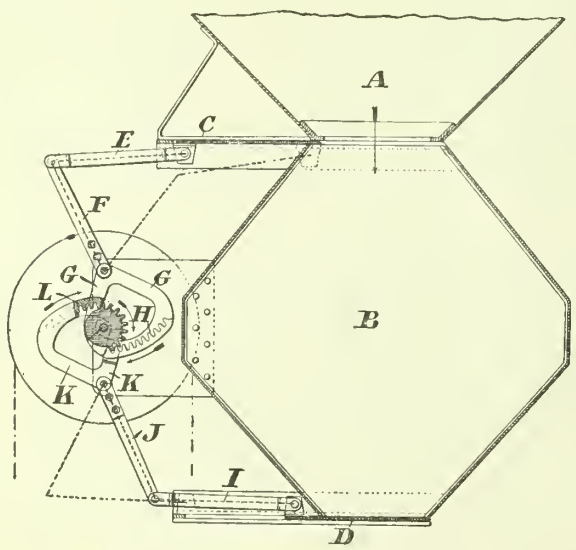
Instead of the lever provided with an adjustable counter-pressure weight as described, there may be substituted a spring (as shown in fig. 3) connected at one end to a boss on a stud adjustable on a screw carried in a bracket attached to the stud. The latter stud is adjustable on the lever, and is connected to the bellows or diaphragm by the rod, as already described. By the use of this combination of adjustable stud connections, the differences in the gas pressures required to light and to extinguish the main burners of the lamp may be regulated to any desired degree.

Measuring Chambers for Coal.

Gibbons, W. P., and Hoyle, H. P., of Lower Gornal.

No. 17,234; July 31, 1906.

This invention consists of the herein described improvements in and connected with measuring chambers for delivering measured quantities of coal and other substances, and particularly for delivering measured quantities of coal for charging gas-retorts, boiler firing, and other purposes.



Gibbons and Hoyle's Coal-Measuring Chambers.

The illustration shows a front sectional elevation of the lower part of a coal-hopper and measuring chamber and its sliding doors with the invention applied to it; the doors and mechanism being shown in the positions they occupy while the measuring chamber is being filled from the hopper.

The upper sliding door C is connected by the connecting link E to the upper end of the lever F, which is mounted on a fulcrum shaft carried by side bracket plates from the sides of the measuring chamber B. Below the fulcrum the lever is prolonged at G and formed with an internally toothed curved rack or sector H, which gears with a toothed sector pinion mounted on a counter shaft, also carried in bearings by the bracket plates. The bottom sliding door D is connected by a link I to the lower end of a lever J, mounted on a fulcrum shaft carried by the bracket plates and prolonged at K beyond the fulcrum. At its outer part it is made with an internally toothed curved rack or sector L, which also gears with the sector pinion, but at the opposite side of it to the rack H. The sector pinion is made with teeth around only about half its circumference, adapted to engage alternately with the curved racks H and L.

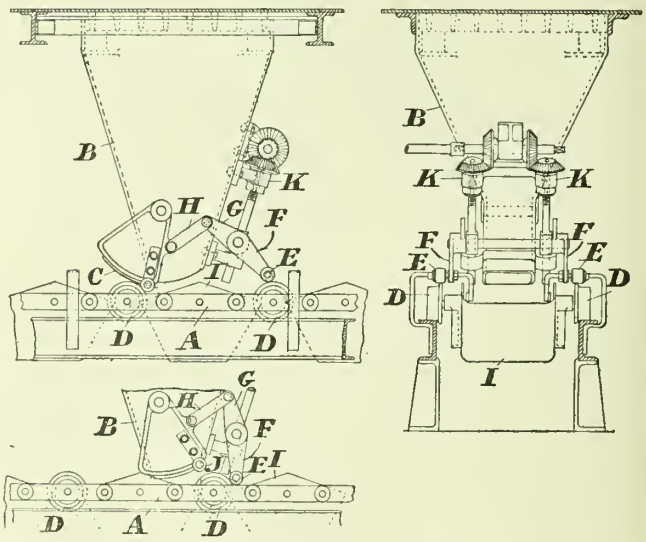
Assuming that the bottom door D of the chamber B is closed as shown, and that the top door C is open and the chamber B is filled with coal from the hopper A above it, then when the operating shaft is turned in the direction indicated by the arrow the teeth of the sector pinion gear with the toothed rack part H of the operating lever F and gradually closes the door C; but the bottom door D remains stationary and closed, because the plain part of the sector pinion is adjacent to the toothed rack part L of the lever J belonging to the door D. When the door C has thus been closed the last tooth of the sector pinion has passed the toothed rack of the lever F, so that the door C remains closed; and as the rotary movement of the sector pinion is continued, its teeth gear with the toothed rack L and commence to open the sliding door D. The movement is continued until the door is fully opened and the contents of the measuring chamber have been discharged. The operating shaft and the sector pinion are now rotated in the opposite direction, so that the door D is first closed; and after this has been done, the last tooth of the sector pinion has left the toothed rack of the lower door, and now the teeth of the sector pinion commence to gear with the toothed rack of the lever F, so that the door C commences to open. This movement is continued until the door is fully open and the measuring chamber B is again filled from the hopper A.

Feed Gear for Conveyors and Elevators.

Edgar Allen and Co. and James, C. W., of Sheffield.

No. 17,624; Aug. 4, 1906.

This invention relates to gear for feeding conveyors and elevators, provided with swivelling buckets; the object being to so regulate the feed of the material that the quantity fed into each bucket shall be evenly distributed and the fall of material between the buckets prevented.



Allen and James's Feed Gear for Conveyors.

Above a portion of the conveyor A, which travels in a horizontal direction, is placed a hopper B, provided with a radial sliding door C at its bottom orifice, the movements of which are actuated by the travelling wheels or runners D of the conveyor which come into contact with rollers E J. For the opening movement, the rollers E, attached to levers F, are so arranged that when the travelling wheels D of the conveyor come in contact with them one arm F of a double lever, to which they are attached, is lifted, while the other arm G, which is connected by a link or bridle H to the side of the door, is depressed and causes the radial door C to open backwards. In this way, the feed into the buckets I commences from the front edge of the hopper orifice into the leading or front end of the swivelling bucket; and by the time the trailing end of the bucket is opposite the back edge of the hopper, the door is fully open. At the same moment the other rollers J, attached to the door C, come in contact with the next or following pair of conveyor wheels D—closing the door during the time the space between the two buckets is passing under the hopper. The moment the door is closed, the first rollers E, which by the motion of the closing of the door have been brought back to the first position, come in contact with the same pair of conveyor wheels D as effected the closing of the door, upon which the opening movement as first described is repeated, and so on continuously for every pair of wheels and every bucket in the conveyor.

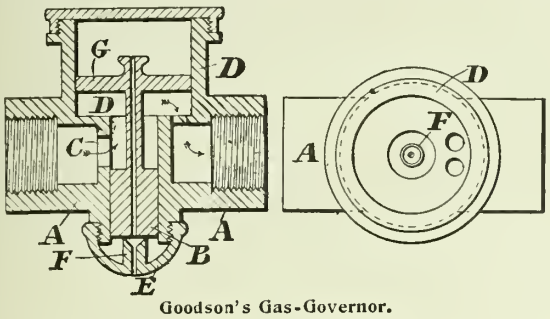
Gas Regulator or Governor.

Goodson, J., of Maze Pond, S E.

No. 20,846; Sept. 19, 1906.

This automatic gas regulator or governor is intended to control the pressure of gas supplied to a variable number of burners notwithstanding variations of pressure in the service-pipe, so that should any of the burners under control be turned off or on, the remaining ones would be practically unaffected. The arrangement comprises: A cylinder and a piston working in it—the space above the piston having a vent

or outlet to the atmosphere, while the space below the piston (through which the gas is caused to pass) communicates with an outlet for the gas; a valve-chamber below the cylinder in communication with the space below the piston; and a valve controlling the inlet to the valve chamber and cylinder and connected with the piston. A removable cover closing the top of the cylinder enables the piston and valve to be removed and easily cleaned.



Goodson's Gas-Governor.

The governor comprises the lower barrel portion A, internally screw-threaded at opposite ends and adapted to be inserted in the service-pipe. Between the inlet and the outlet end, a cylindrical valve chamber is formed transversely to the axis of the barrel, and in which the valve B is guided. The valve-chamber communicates at one side, through a port C, with the inlet; while its upper end opens into a cylinder D, arranged co-axially with the valve-chamber. At its lower end the valve-chamber or guide is closed by a screw cap E, provided with a central stop or rest F, which supports the valve when in its lowest position. A piston G, formed integral with the shank or spindle of the valve, works in the cylinder D; being raised and lowered as the pressure of gas varies—thus raising and lowering the valve which controls the inlet port. The top of the cylinder is closed by a screw cap or cover, and a vent is provided in the cylinder just below the flange of the cap, or, as shown, it may be formed by boring through the piston and valve, and may communicate with an outlet in the lower cap E. This vent maintains the part of the cylinder above the piston at atmospheric pressure.

In operation the gas passes in the direction of the arrows, through the port C, to the space below the piston G, and from thence through openings to the outlet; being throttled more or less at C according to the pressure.

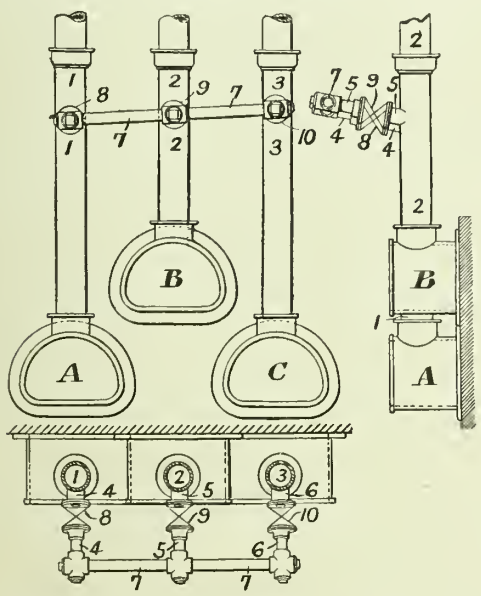
Preventing Choking of Ascension Pipes of Retorts.

Gibbons, W. P., of Lower Gornal, and Judd, G. H., of Sheringham.

No. 24,418; Nov. 1, 1906.

This invention is designed not only to prevent choking of the ascension pipes of gas-retorts, but it "also has the effect of making more gas per ton of coal, and of a more uniform quality, than is possible with the ordinary arrangement of ascension pipes, which are usually independent of each other and form separate and independent passages from the various retorts to the hydraulic main."

It is well known, the patentees remark, that the gas from a retort freshly charged with coal contains more moisture than that given off in the latter part of the time during which the coal is allowed to remain in the retort. It is also well known that the stopping up of the ascension pipe is "largely due to the dry condition of the gas passing therethrough at the latter end of this period." They therefore "provide means whereby the gas from the freshly-charged retorts is to some extent passed up the ascension pipes of the retorts to be charged next, or next but one, and in which the gas contains less moisture."



Gibbons and Judd's Arrangement of Ascension Pipes.

In the arrangement illustrated, in order that some of the gas from one or more retorts can be conveyed to the ascension pipe or pipes of some other retort or retorts, each of the ascension pipes 1, 2, and 3 is made with a branch pipe 4, 5, or 6, a short distance above the mouthpiece, and connected together by a separate connecting pipe 7 of a smaller diameter than the ascension pipes. Each branch is fitted with a valve 8, 9, or 10; the arrangement being such that all the ascension pipes in the bed, or any of them, can be connected together, so that some of the gas from any of the mouthpieces A, B, C can, after passing up the lower parts of the ascension pipes 1, 2, and 3, below the connecting pipe 7, be caused to pass along the connecting pipe 7 and up the ascension pipes belonging to some other retort or retorts. The connecting pipe 7 is by preference made to slant across the whole of the ascension pipes or across any group of ascension pipes in the bed, so as the better to free itself from obstructions; or, if desired, the pipe may slant both ways to or from the central ascension pipe of the bed or of the group of ascension pipes, or be otherwise arranged so that there will be sufficient fall for the tar and liquor to properly run down and prevent the connecting pipe being choked.

The method of working the retorts A, B, C, having their ascension pipes 1, 2, 3 connected together, would be as follows: Assuming, for instance, that the retort A is charged at eight o'clock, the retort B at ten o'clock, and the retort C at twelve o'clock. Then, immediately after the retort A has been charged, the valve 10 of the retort C is closed and the valves 8 and 9 are opened. Thus some of the gas from the retort A can pass along the pipe 7 and up the ascension pipe 2 of the retort B. Immediately after the retort B has been charged, the valve 8 of the retort A is closed, and the valves 9 and 10 are opened. Thus some of the gas from the retort B can pass along the pipe 7 and up the ascension pipe 3 of the retort C. Immediately after the retort C has been charged, the valve 9 of the retort B is closed and the valves 10 and 8 are opened, so that some of the gas can pass from the retort C along the pipe 7 and up the ascension pipe 1 of the retort A; and so on in the same rotation.

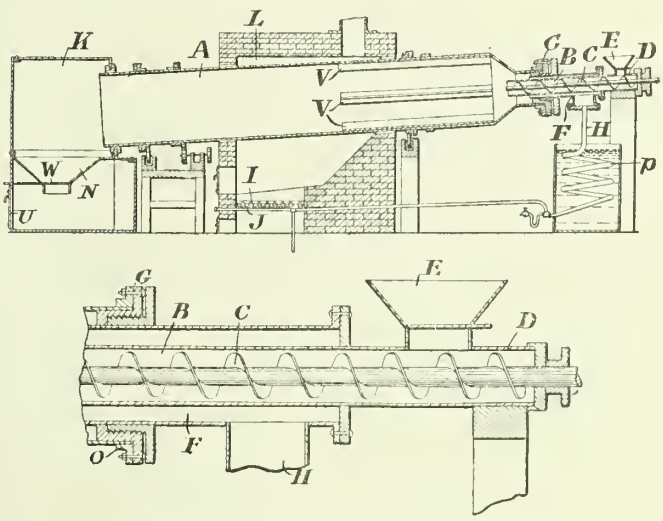
Or the retorts may be worked in the following manner: Immediately after the retort A has been charged, the valve 9 belonging to the retort B is closed, and the valves 8 and 10 are opened, so that some of the gas from the retort A can pass along the connecting pipe 7 and up the ascension pipe 3 of the retort C. Immediately after the retort B is charged, the valve 10 belonging to the retort C is closed, and the valves 8 and 9 are opened, so that some of the gas from the retort B can pass along the branch pipe 7 to the ascension pipe 1 of the retort A. Immediately after the retort C has been charged, the valve 8 of the retort A is closed, and the valves 9 and 10 are opened, so that some of the gas can pass from the retort C, along the branch pipe 7, up the ascension pipe 2 of the retort B.

Distilling and Carbonizing in Revolving Retorts.

Robinson, E. B., of Hurlet, near Glasgow, and Edwards, W. C., of Rockland, Ontario, Canada.

No. 24,961; Nov. 6, 1906.

This invention relates primarily to the simultaneous distillation and carbonization of sawdust, chipped wood, and wood refuse, with the object of recovering from them "by a continuous process, a maximum amount of volatile and solid product." It consists of apparatus in which the material is distilled and carbonized in a continuously rotating retort while continuously applying heat thereto, and collecting separately the volatile and solid products. The cylindrical retort is supported with its axis slightly inclined to the horizon and rotated by any suitable means; the volatile products resulting from the operation of the process being withdrawn from the upper end of the retort and the non-volatile products from the lower end.



Robinson and Edwards's Revolving Retort.

A is the retort supported at intervals on rollers with its axis slightly inclined to the horizon—preferably by the means shown, comprising fixed seats of rollers which run on tracks secured to the outside of the retort. Means are provided for rotating the retort—such as a driving pinion which engages an annular gear secured to the outside of the retort.

The heating of the retort may be accomplished by a masonry chamber L, which encloses the retort for a portion of its length. This chamber is provided with the usual grate-bars directly below but within the combustion chamber. If desired, steam, or superheated steam, may be introduced into the interior of the retort to assist in the carbonization and distillation. The raw material is introduced into the retort at or near the upper end—a feeding device B being provided to effect its introduction and passage therein.

This feeding device comprises a rotary spiral conveyor C, which operates in a fixed tube D extending to the end of the retort. To feed

the material into the conveyor tube, a hopper E is connected externally, and is provided at the bottom with a slide adapted to close the hopper and prevent the escape through it of the volatile products within the retort when the material is not being fed into it.

Connected to the tube D, and encircling it, is a second tube F, through which the volatile products pass to the condenser or may be withdrawn. The outside of this tube is connected to the end of the retort by a gland G, which, during the rotation of the retort, prevents the escape of the volatile products. This gland may be of any design; but that shown comprises an annular ring the inner side of which bears on the outside of the tube F—the ring having a screw-threaded engagement with a like ring bolted to a third ring secured to the end of the retort.

The tube F is connected at a point outside the retort to a conducting tube H, which leads to the coils of a worm or any other form of condensing apparatus. The gaseous products passing through uncondensed and in the condenser may be withdrawn and burned to assist in heating the retort.

With this end in view, there is a conducting pipe connected to the coil and leading to a burner J (of any suitable type) below the grate-bars in the heating-chamber. To enable the volatile products to be withdrawn more readily, a steam-jet exhauster is located in the pipe, or a vacuum pump or fan exhauster might be employed in place of the steam-jet exhauster.

The non-volatile products are withdrawn through the end of the retort by any desired means, such as a fixed collecting chamber K connected to the end of the retort by a gland. The bottom of the collecting chamber is made in the form of a hopper N, which empties into a second chamber O, provided with a door through which the material may be withdrawn. The bottom of the hopper is furnished with a slide by means of which the hopper may be closed when the door is open to withdraw material, thereby preventing the entrance of air into the heated retort. If desired, this collecting chamber may be dispensed with, and the products may be withdrawn by means of a spiral conveyor extending into the end of the retort.

To mix the material during its passage through the retort, and to prevent caking, there are a number of mixing blades secured to the interior of the retort.

The material to be distilled or carbonized is fed into the hopper E, whence it will be conveyed by the conveyor C to the upper end of the retort A. The retort being slightly inclined to the horizon, the material will, under the action of gravity, be fed therethrough; and as the retort is continuously rotated, it will be rotated and "present different parts thereof to the action of the heat" during passage through the heating chamber L. In this way "all the parts of the material receive a continuous and equal amount of heat, which makes the distillation and carbonization uniform throughout." The mixing blades operate on the material to keep it in a finely-divided state and prevent caking.

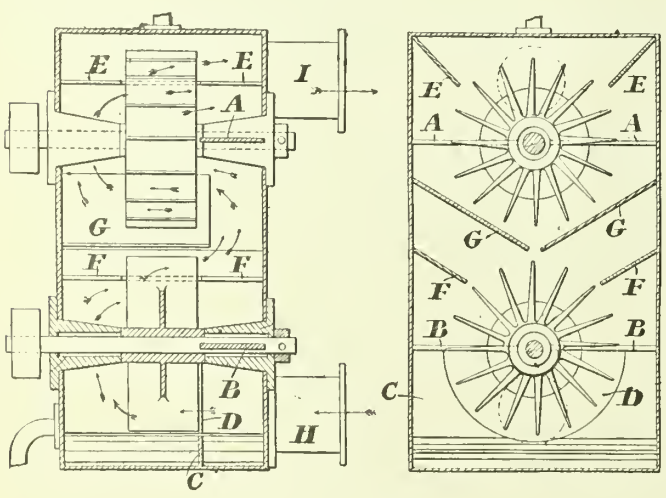
The action of the heat both vaporizes and carbonizes the material; the volatile products passing off into the continuous coil at the upper end, and being therein condensed or else passing off uncondensed. The non-volatile or carbonized products pass down and fall through the lower end of the retort into the collecting chamber K, whence they may be withdrawn. The gaseous products which do not condense in I are burned at J to assist in the heating of the furnace, and thus effect an economy in the operation. The products of distillation and carbonization will, it is said, be found very uniform in their character, "owing to the thorough exposure of all particles of the raw material to the action of heat."

Gas-Washing Machines.

Wilson, A., of Stafford.

No. 29,471; Dec. 27, 1906.

This invention relates to gas-washing machines where paddle-wheels are employed for agitating the gas and causing intimate contact of it with the water contained in the apparatus.



Wilson's Gas-Washer.

The illustration shows sectional elevations at right angles to one another, of one construction of such machine.

The paddle-wheels are fixed on shafts supported in upper and lower bearings on opposite side walls of a casing; the shafts being provided with driving pulleys. A B are upper and lower horizontal partitions in the casing, and C is a vertical partition fixed in the lower part of the casing below the lower horizontal partitions and formed with a semi-circular opening D, which extends in front of the lower half of the lower paddle-wheel at the gas entrance end of the casing. A number of deflecting or baffle plates E F extend inwardly and downwardly from the opposite ends of the casing, and are located in a suitable position in relation to the paddle-wheels, as shown. G are other inwardly and downwardly inclined plates arranged below the upper paddle-wheel, so as to form a doubly inclined bottom extending across a portion of the upper part of the casing and having a central delivery opening through which the water can pass from the upper part of the casing and be brought into "direct and effective" contact with the paddle-wheel in the lower part. Water is admitted to the top of the casing, so as to fall upon the upper paddle-wheel. The greater part of the water thrown off by wheels, instead of running idly down the sides of the casing, is caught by the deflecting plates and is again returned to the paddle-wheel; the water, together with the gas, passing through the central opening into the lower part of the casing, where it will be similarly acted upon by the lower revolving paddle-wheel and plates F. The water finally escapes from the lower portion of the casing, through a pipe dipping into a water seal.

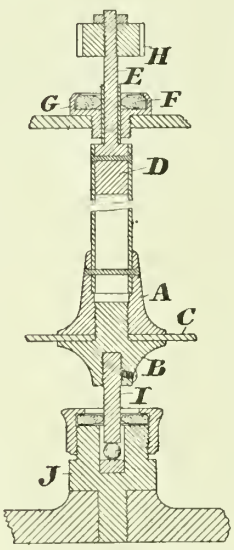
The gas to be washed enters through the pipe H and passes to and fro between the floats of the revolving wheels in the direction of the arrows before it finally escapes "in a purified condition" from the top of the casing through the pipe I.

Turbine-Wheel Gas-Meters.

Thorp, T., of Whitefield, near Manchester.

No. 3140; Feb. 8, 1907. Date claimed under International Convention, July 9, 1906.

This invention relates to turbine or fan-wheel gas-meters as described in patent No. 20,214 of 1901.



Thorp's Turbine-Wheel Gas-Meter Spindle.

When such gas-meters are used for carburetted water gas, enriched coal gas, oil gas, and the like, oily liquids of condensation are found to be deposited in the spindle bearings, clogging them and preventing the "nearly frictionless rotation required for the fan-wheel spindles of such meters" and so "injuriously affect the correct registration of the meter." In some cases, too, where coke-oven, generator, or furnace gases have to be measured and are not perfectly washed, gritty particles are contained in the gas, which become mixed with the oil in the footstep and impede its rotation. The object of this invention is to remedy these defects.

As represented, the spindle consists of a hollow tube fixed in a boss A, into which another boss B is screwed—the bosses gripping the disc C of the fan-wheel between them. Into the upper end of the spindle, a plug D, formed with a pivot E, is fixed. The pivot has a hard brass sleeve tightly driven upon it, which revolves in an agate ring F fixed in the screw plug G—the latter screwed into a horizontal plate. At the top, the pivot has a pinion H fixed upon it, by which the rotation of the spindle is transmitted to the register.

Into the bottom of the boss B a hardened steel pivot I is screwed, which enters into the iron footstep bearing J. The latter is screwed into, or fixed on, the plate underneath the disc C of the fan-wheel, and is bored out to a larger diameter than that of the pivot I. Preferably a hardened steel plate or agate plate is inserted into the bottom end of the bore, and a hardened ball of smaller diameter than the bore is between the pivot and plate. Upon the top of the bearing J an agate ring is fixed by means of a cap screwed upon the bearing J—leather washers being interposed between the ring and the metal parts. The space surrounding the pivot I and the ball is filled with mercury. When the spindle rotates, the ball makes a gyrating movement, and "an almost frictionless motion is assured;" while the mercury "effectually prevents the entry of oil and grit into the footstep bearing, which requires no further attention and does not become clogged while the meter is stopped for a time."

APPLICATIONS FOR LETTERS PATENT.

13,955.—Brückmann, O. J., "Gas-producers." June 17.
14,063.—Huntrods, L., "Supporting mantles." June 18.
14,078.—Edgar, W., "Fuel for gas-fires." June 18.
14,091.—White, F. R., "Gas-engines." June 18.
14,112.—Thorp, T., "Water-meters." June 19.
14,127.—Potter, W. G., "Incandescent burners." June 19.
14,158.—Holman, S., "Burners." June 19.
14,161.—Wakefield, H., "Incandescent burners." June 19.
14,162.—Plumstead, E., and Newton and Lawrence, Ltd., "Igniting gas electrically." June 19.
14,197.—Mansfield, A., "Oil gas." June 19.
14,200.—Robin, J. I., "Inverted burners." June 19.
14,201.—Robin, J. I., "Brackets and mantle supports." June 19.
14,202.—James, C. B., "Support for incandescent lighting." June 19.
14,210.—Greenfield, J., "Coin-freed meters." June 20.
14,213.—Bellamy, A. R., "Gas-engines." June 20.
14,239.—Bouck, J., "Treatment of coal." June 20.
14,254.—Pöschl, A., "Inverted gas-lamps." June 20.
14,317.—Thorp, T., "Bunsen burners." June 21.
14,320.—Birch, G., "Anti-vibrator." June 21.
14,341.—Ries, H., "Gas-retort furnaces." June 21.
14,348.—Thwaite, B. H., "Coal distillation." June 21.
14,371.—Carpenter, C. C., "Distillation of coal." June 21.
14,398.—M'Gillivray, J., "Incandescent burners." June 22.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Tar for Roads and Workmen's Compensation.

SIR,—May I, through the "JOURNAL," congratulate my friend, Mr. Hunt, and with him all who helped to make the Dublin meeting of the Institution of Gas Engineers such a great success from every point of view? There were many questions of great interest discussed at the meeting—two of which call for a word from me.

First, as to tar. Mr. Maybury said that, through me, he was "able to obtain supplies for use in his county [Kent] at the low price of 1d. per gallon," *plus* freightage. These are the facts. The South Suburban Gas Company recently asked for tenders for their tar for a year. The offers varied slightly in amount; but the two highest were 17s. 6d. per ton, or about 1d. per gallon. One was from a tar distiller (several distillers tendered, but this was the highest), the other, at the same price, was from a railway company for burning in their locomotives. This, in fact, is what tar has come to, a rock-bottom price—viz., its value as fuel. Under these circumstances, the Board agreed to sell for road purposes at the same price; and this seems to me to be fair and reasonable. We badly want to reduce the quantity of tar we have to sell for distilling. It is, therefore, greatly to the interest of the gas industry to cultivate another promising market, and to sell for road-making at the price we get under contract from the distillers.

Now as to workmen's compensation. This important question, so opportunely introduced by Mr. Stafford Ellery, can be dealt with in a vastly better way than by insurance, excepting perhaps very small companies—better for the men, better for the company; for unless it were so for both it would not be advocated by me.

The South Metropolitan and the South Suburban Gas Companies have now had—the former ten years and the latter five years'—experience of contracting-out of the Act by means of Mutual Accident Funds. I believe the premium charged by insurance companies under the old Act was from about 8s. to 10s. per cent. on wages; and it is said they are now asking 17s. 6d. per cent. under the new Act.

Compensation for all accidents—including the first fortnight, with medical attendance and pensions to the widows of men who lost their lives in the Company's service, all on a more liberal scale than the Act required—cost the Mutual Accident Fund of the South Metropolitan Company last year £1435 for 6079 men, whose wages average 33s. 1d. per week. This works out to 4s. 9d. per man, or 5s. 6d. per cent. on their wages per annum. The new Act will add slightly to the cost, but certainly not more than 1s. 6d. per cent.; and at this rate it will be considerably less than half that of insurance.

This is not the result of an isolated year. The previous year was about the same; and the experience of the South Suburban Company confirms it.

How is it done? Simply by the principle of co-partnership, whereby employers and employed are united in friendly association for the prevention of accidents, which is infinitely better than compensation. The system has effected a great reduction in the percentage of accidents to the men employed, which is only half that of ten years ago.

We are now preparing a new scheme under the new Act, which shall be sent to you when settled. In the meantime, full information will be gladly given to any of our brethren interested in the subject on application to either Company.

GEORGE LIVESEY.

June 28, 1907.

Mr. Lyne on Mr. Tooms's Gas Institution Paper.

SIR,—The report appearing in the "JOURNAL" of the 25th inst. of the few remarks made by me on Mr. Tooms's paper at the recent meeting of the Institution of Gas Engineers is, I beg leave to say, not quite correct. This inaccuracy is not to be attributed to your reporter; but rather to the fact that I did not speak sufficiently loud, and also to the fact that I was needlessly interrupted. I say needlessly, because I consider that I was quite within my rights in controverting some of the unproved statements of the writer of the paper; and any explanation of the meaning which Mr. Tooms wished to be attached to his words, or of the points which he desired to be conveyed (though not divulged in plain English), might have reasonably been deferred until I had concluded, if the object had not been to intercept the trend of my thought, which, let me hope, was not the case.

Mr. Tooms argued, for instance, that the increased consumption of gas depended more on the out-door service rendered to customers than on the price per 1000 cubic feet at which it is sold. This was his contention; but he made no effort to prove it. While not wishing to decry some of the methods advocated in the paper, I was prepared to show that price has a strong determining influence in increasing or lessening the consumption of gas. Take, for instance, the group of towns in Table I. of the paper:—

	Cubic Feet.
Waterford, with a price of 3s. 9d., has a make per head of	3033
Tipperary, price 4s. 11¾d., make per head	2419
Kilkenny, price 5s., make per head	2167
Fermoy, price 5s. 2½d., make per head	1411
Mallow, price 5s. 8d., make per head	1168

And so on. Secondly, by comparing Waterford itself with towns where the price of gas is lower than at Waterford.

	Cubic Feet.
Belfast, price 2s. 3d., less discount, make per head	5487
Bangor, price 3s. 6d., less discount, make per head	5007
Dublin, price 3s. 4d., make per head	4100
Wexford, price 2s. 9d., make per head	3689
Cork, price 3s. 4d., make per head	3402
Waterford, price 3s. 9d., make per head	3033

Without going any farther, I think this proves clearly the influence a moderate price has in increasing the quantity of gas used; and be it noted that some of the towns named above, which sell gas at a lower price than Waterford, are of less importance, and have smaller populations. Permit me to say here that I did not state that Mallow and Middleton came immediately after Portadown in cubic feet of gas per head. Far from it. But I did say that Middleton, with only 3361 of population, had a larger consumption per head than Mallow, with a population of 4452. Mallow is a much more important town than Middleton. The make of gas per head in Middleton is 1725 cubic feet, and in Mallow 1168 cubic feet. Both towns are in County Cork, and within a very short distance of each other. The price of gas at Middleton is only 4s. 7d. per 1000 cubic feet; at Mallow it is 5s. 8d.—one more instance of the good effect of a reasonable price. So far as I know, there has been no extra pushing in Middleton; but it is reasonable to assume that the managers of the Middleton gas undertaking have been attending to their duty and are alive to the interest of their customers. Other towns in the group mentioned in Table I. of the paper compare unfavourably in price and in cubic feet of gas per head with towns of similar size not named in the same table, and not very far away from them. It is not necessary that I should trouble you or your readers with the figures.

As I said at the meeting, the inference to be drawn from the paper is that no other towns in Ireland were making anything like the progress of those mentioned in Table I.; that the managers of those undertakings took little or no interest in increasing the sale of gas, and that they did not care to arouse the attention of their customers to the advantages to be derived from using incandescent burners.

I cannot say from my own knowledge what has been done by numerous towns not named in Table I.; but I feel pretty certain, from the figures I have given above, and from others I have studied, that they are doing their duty. I can say for the town from which I write that the increase in the consumption of gas has been brought nearly to a standstill from the large number of incandescent burners that have been fixed during the last few years. Fortunately, another source of consumption has been tapped which is certain to stay, and which is being developed very steadily.

Before closing this letter, I would remind readers of it that we had this group of small Irish towns before the Institution meeting last year in another form; and they appeared, according to the report in your columns, before the Irish Association meeting held in Dublin last year in still another form. We have had them at the recent meeting; and I should not be surprised if we hear more about them at the Institution meeting to be held in London next year. No doubt all this must be very instructive to the members of the Institution of Gas Engineers, and I suppose we cannot have too much of it!

J. LYNE.

Wexford, June 29, 1907.

Mr. Copp's Institution Paper.

SIR,—With reference to my Institution paper, on "Incandescent Gas Lighting," I much appreciate your excellent report, and also the manner in which you have reproduced the illustrations. But I would point out that the numbers of the illustrations have in some way been altered, so that the results of the tests, and the remarks in the appendix relating thereto, are totally inapplicable, and, unless corrected, I am afraid will lead me into serious difficulty. The numbering should have been the same as in the advance copy printed for the Institution meeting; and, in order to prevent misapprehension, I think that it would be as well if you would make the correction in the next issue of the "JOURNAL."

I may add that the reason the illustrations corresponding with some of the numbers were omitted, is that these burners are either familiar to everyone, or that their construction does not involve any features of special interest.

HAROLD E. COPP.

West Bromwich, June 27, 1907.

[In accordance with our correspondent's intimation, it may be mentioned that figs. 1 to 8 of Drawing No. 1 (p. 963) should have been numbered figs. 1, 3, 4, 5, 6, 7, 8, and 10; that figs. 1 to 5 of Drawing No. 2 (p. 964) should have been figs. 1, 2, 3, 5, and 6; and that figs. 1 and 2 of Drawing No. 3 (p. 965) should have been Nos. 6 and 7.—ED. J.G.L.]

Protecting Meter-Couplings.

SIR,—We have been interested to read the letter of Mr. Cox in the last number of the "JOURNAL." We enclose for your perusal a copy of Mr. Cox's complete specification and one of our own, by which you will see the different nature of the two inventions.

Mr. Cox's claim, as described in his specification, is for a protective appliance for pipe connections and fittings and for other purposes, consisting of a two-part hinged casing tapped at one end to receive a form of screwed locking-pin having threads of different diameters running in different directions. Our invention is for an appliance to prevent tampering with the unions of gas-meters, consisting of two half-circle troughs having holed lugs at their ends; the two halves being joined together by lead eyelets similar to those used in our patent sealed padlock for prepayment meters.

We would not presume to compare the merits of the two inventions, but beg to point out that the idea of protecting the unions of gas-meters is a very old one; and we enclose you a copy of a specification taken out in 1879 by Mr. G. F. L. Foulger for protecting these unions.

THOMAS GLOVER AND CO., LIMITED,
Per THOMAS GLOVER.

Gothic Works, Upper Edmonton, N., June 28, 1907.

Visits of English Engineers to Foreign Works.

SIR,—In a reference published in various technical journals to a recent visit paid by the members of the Society of Engineers to the new reservoirs being constructed at Honor Oak for the Metropolitan Water Board, it is stated that these will contain nearly 60 million gallons of water, and that they will probably be the largest covered reservoirs in the world. Such a statement proves very conclusively the value of visits to large and notable works, especially when such visits are extended to

countries other than our own—an opinion recently stated publicly by Mr. Brodie, the Borough Engineer of Liverpool, in connection with the visit there of the Association of Municipal and County Engineers.

My purpose in calling the attention of your readers to the above matter is to point out that the recent visit of the Association of Water Engineers to Paris brought home to the members the fact that in the year 1900 a covered reservoir was carried out by the Municipality of Paris, at St. Cloud, which has a capacity of 66 million gallons, or 10 per cent. more than that of the Honor Oak reservoirs; and the statement I have quoted seems to emphasize the necessity for engineers to acquaint themselves with the work of our Continental neighbours before making or accepting statements which a fuller knowledge would prove to be unwarranted.

In many other respects than that above mentioned, the recent visit of the Association of Water Engineers to Paris has proved of unusual interest and value. The general use of an independent supply of unfiltered water for municipal and trade purposes, the construction of sewers providing accommodation for water-mains, pneumatic tubes, telegraph and telephone cables, &c., as well as discharging the ordinary functions of sewers, the free use of armoured concrete in water-works and other engineering structures, are examples of French practice which, whether suitable for imitation in this country or not, should be studied by all Englisb engineers who claim experience as well as ability.

In the filtration of potable water supplies, our neigbbours, once so far behind the standard of practice in England, have now advanced until it is our turn to learn from them. The decision of the Derwent Valley Water Board (acting under the advice of their Engineer, Mr. Edward Sandeman, M.Inst.C.E.) to adopt the Puech system of filtration, which is now almost universally applied to the river water supplied for potable purposes by the Municipality of Paris, is an excellent illustration and a definite proof of this statement.

Difficult and costly though it be for engineers to qualify themselves in the manner I have indicated, still the organization of foreign tours such as the Water Engineers have carried through successfully on two occasions affords a splendid opportunity of acquiring such experience at a minimum of trouble and expense; and I think your readers will be well advised to encourage and support every effort of the kind that may be brought under their notice.

Chislehurst, June 27, 1907. EASTON DEVONSHIRE.

LEGAL INTELLIGENCE.

ALLEGED GAS POISONING IN GLASGOW.

In the Court of Session last Tuesday, Lord GUTHRIE heard Counsel in the adjustment of issues for trial by jury of the action, reported last week (p. 1009), in which Edward and Mrs. M'Andrew and Mrs. Convery, residing at No. 12, Carbeth Street, Glasgow, sue the Corporation of Glasgow for damages in respect of poisoning by gas.

Mr. A. CRAWFORD, for the defenders, moved his Lordship to dismiss the action as irrelevant. Gas, he said, was not used in any of the rooms in the tenement; and, on the pursuers' own showing, the gas-main was laid about 6 feet from the building. There was no specific averment that the main was laid in a coup or toom. It was said that defenders failed to inspect the pipe; but such failure would not have caused the accident. There was no proper averment of damage sustained. It was not stated in what way the pursuers suffered.

Mr. A. A. FRASER, for the pursuers, argued that it was tbe duty of the Corporation to have taken precautions against the corrosion of the pipe; but, he averred on record, they failed to do this, and tbus caused the accident. His averments of corrosion and subsidence were sufficient. His theory was that the gas, being unable to find an escape upwards to the street, was driven down, and made its way into the tenement. Defenders admitted that precautions were necessary, because they said the pipe was coated with Dr. Smith's composition.

Mr. COOPER, K.C., replying for the Corporation, said tbat, as a matter of fact, they took up the pipe, and found that there was no corrosion. The Court never beld that a corporation were bound to dig up the ground periodically to see if pipes were in order.

Lord GUTHRIE said there was one averment which was quite relevant—that with reference to Rose Ann Convery, who died on account of the escape of gas. The case, therefore, must go to trial. The record had been acutely criticized on behalf of the Corporation, and the criticism was by no means without substance; but a record of this kind was not to be dealt with as if it were a deed of entail. If there could be spelt out of it a relevant case, and if the defenders received sufficient notice of the case—which was the really practical question—the Court would not refuse to send it to trial. With regard to the pursuers' averments that there was a coup, and as to the failure to see that the pipe was actually leaking, he thought that while they lacked the precision they might have had, it was quite evident that the defenders knew exactly what the pursuers' case was, and understood it. With regard to the question of how the pipe was leaking, the defenders admitted that there was a fault in it, though they attributed it to an accident. Therefore it was enough when the pursuers said that the defenders laid a gas-pipe in a faulty and defective manner. With regard to corrosion, though it was by inference instead of by direct statement, tbey had it stated that if certain things had been done the fracture would have been prevented. He therefore thought that the objections could not be given effect to. It was admitted that the death of Rose Ann Convery was properly set out. With regard to the others, if they exhibited acute symptoms of poisoning by gas, and this was due to the action of the defenders, the defenders must pay. It might be that the pursuers would not recover the sums they sued for; but this was a question of expenses, and should not prevent the case going to trial. He therefore approved of the issues.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills reported: Broadstairs and St. Peter's Urban District Water Bill, Portishead District Water Bill.

Bill read the third time and passed: Colne Valley Water Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bill brought from the Lords, read the first time, and referred to the Examiners: Colne Valley Water Bill.

Lords Bills read a second time and committed: Coventry Corporation Bill, Sheffield Corporation Bill, Tynemouth Corporation (Water) Bill.

Bills reported: Heywood and Middleton Water Board Bill [Lords], Metropolitan Water Board (Charges, &c.) Bill, Metropolitan Water Board (Various Powers) Bill, Wisbech Water Bill [Lords].

Lords Bills read the third time and passed: Birmingham Corporation Water Bill, St. Neot's Urban District Council Bill.

Petitions have been presented against the Birkenhead Corporation Water Bill [Lords], by the Liverpool Corporation, the Cheshire and Flintshire County Councils, tbe Chester, West Cheshire, and Wirral Water Companies, and the Dee Conservancy Board.

ANNFIELD PLAIN AND DISTRICT GAS BILL.

House of Lords Committee.—Wednesday, June 26.

(*Before the Earl of* DONOUGHMORE, *Chairman; the Earl of* ABINGDON, *Lord* HAMILTON OF DALZELL, *Lord* KENMORE, *and Lord* BOWES.)

The object of this Bill is to incorporate a Company with power to acquire and construct gas-works, and to manufacture and supply gas in the urban districts of Annfield Plain and Tanfield, in the County of Durham.

Mr. HONORATUS LLOYD, K.C., Mr. VESEY KNOX, K.C., and Mr. CLEASE represented the promoters (Messrs. Lees and Butterworth being the Parliamentary Agents); the Hon. J. D. FITZGERALD, K.C., and Mr. G. J. TALBOT, K.C., appeared in support of the petition of the Annfield Urban District Council (Messrs. Dyson and Co., Agents), who opposed the Bill.

Mr. VESEY KNOX, in the absence of Mr. Honoratus Lloyd, opened the case, and remarked that Annfield was situated in a colliery district, where the population had of late years been rapidly increasing. The area was 3489 acres, and the part of Tanfield (the adjoining district) which the promoters were taking, was roughly 4000 acres. There was no opposition to the Bill from Tanfield; but the Annfield Plain Urban District Council, who had opposed them in the House of Commons, again objected. The state of the gas supply in the district had not been very satisfactory up till now. He did not think it could be seriously disputed that some alteration was wanted, and that a company having statutory powers would be an improvement, In Tanfield and Annfield there were two separate gas-works. There were some works at West Kyo which were owned by the Annfield Plain Gas Company, and there were other works at Dipton which had private owners. In Tanfield, there were works owned under a partnership; and other works of which the owners were Messrs. James Joicey and Co., Limited. None of the owners of these works had statutory powers; and the position of a non-statutory gas company was, in many ways, an unsatisfactory one. Every time they opened the roads they committed an indictable offence; and they were under no obligation to furnish a supply of gas. However, Mr. Schultz and Mr. Comins visited the district and purchased the works at Dipton and West Kyo; the total outlay they had incurred being £9731. A main was laid connecting the two works, and other extensions were carried out, involving a cost of another £2400. But as soon as the Bill was deposited, the Local Authority put their veto on the laying of mains, and bad apparently done everything they could to prevent the would-be consumers of gas from getting a supply. Messrs. Schultz and Comins had actually a list of 288 people who were asking for gas, and who were waiting for the Bill to be passed, for the veto of the Local Authority to be removed. There were other gentlemen, of good commercial position, who were associated with Messrs. Schultz and Comins, and were joint promoters of the Bill. There was an obvious objection to Messrs. Schultz and Comins themselves fixing the price to be paid for their works; and it had been thought that the most convenient plan would be to allow the figure to be determined by arbitration as between them and the new Company to be incorporated under the Bill. An agreement was made under which the owners were to sell and tbe Company were to purchase the property at a price to be settled by a single arbitrator; and the price was to be paid by the issue of fully-paid shares in tbe Company. It had been objected to this that the works were not worth what had been paid for them; and this seemed to be a reason for having an arbitration clause. When power was taken by the promoters to supply Tanfield, it was done because there were mains laid into it from Dipton; and it was thought that the district might fairly be included in the limits of supply. The House of Commons Committee, however, in giving their decision on the Bill, provided that Tanfield should be included, on the understanding that the Company in the North were communicated with, to see if they had any objection to raise before the Committee. It was found that Lord Joicey's Company did not desire to sell; and his interests had been entirely protected by an amendment

of the Bill, by which the promoters struck out of their limits the part of Tanfield supplied by Lord Joicey's Company. It was also provided that the Company should, within six months from the passing of the Bill, purchase from Messrs. Joicey and Co., and this firm should sell, the gas mains, pipes, and apparatus belonging to them in the part of the village of Whiteley Head which was within the boundary of the Annfield Plain urban district, at such a price as, failing agreement, should be settled by the arbitrator appointed under the Act; and the Company were also to pay to Messrs. Joicey and Co. such compensation in respect of the loss sustained by them by reason of their ceasing to supply gas to the 40 houses they supplied as should, failing agreement, be settled by the arbitrator. The price there now was 4s. 6d. per 1000 cubic feet, which was the price proposed under the Bill. The Burnopfield Company were quite willing to sell their undertaking; and Messrs. Schultz, Comins, and Co. had bought the works for £2350, in addition to a further sum for stores, to be fixed by valuation. The gasholders would probably be left in their present positions on the old works; but there was no doubt that the manufacture of the gas could be most economically carried on at the central works at Dipton. With regard to financial considerations, the Committee of the other House had reduced the amount of the proposed capital; and now, by clause 7 of the Bill, it was to be £36,000. The borrowing powers granted were fixed at one-third of the total capital for the time being employed, making £12,000 as the maximum; thus giving a total of £48,000. The promoters would have to buy the existing works, and supply Tanfield as well as Annfield Plain; and the works would bave to be developed. In clause 14 of the Bill, it was set forth that, except as by the Act provided, the profits of the Company to be divided among the shareholders in any year should not exceed 7 per cent. on the ordinary capital and 5 per cent. on the preference capital. By clause 38, the standard price was to be 4s. per 1000 cubic feet; but if they raised it 1d. beyond the 4s., the dividend would be reduced by 3s. 6d. So that if they raised the price 6d. per 1000 cubic feet, the dividend would fall 21s. per cent.; but if they reduced it, they might divide a larger dividend (if properly earned) than the standard. The price of gas at Dipton was 4s. 6d., and in Annfield it had been 3s. 9d.; so that in taking 4s. as the standard, they were going to the limit of safety.

Evidence was then given in support of the Bill.

Mr. *W. A. Schultz* stated that there was a considerable demand for gas in the district. His evidence referred chiefly to the amounts expended on the works.

Mr. *H. C. Walker*, one of the promoters of the Bill, gave evidence to the effect that he was prepared to invest considerable sums of money in the Annfield Plain Gas Company.

In reply to Mr. FITZGERALD, witness said he was aware that gas stocks were commonly bought and sold to pay less than 5 per cent. It was possible that, while Mr. Schultz had spent altogether £12,000 odd, the arbitrator might award bim £20,000.

In reply to Mr. CLEASE, witness agreed that the award might be for only £5000.

Mr. *Edmund H. Stevenson* said he inspected part of the district in question. It had a growing population, and the property which was being built was of a better class. The consumption of gas was now estimated at about 10 million cubic feet per annum; but the works were capable of supplying a much larger quantity—there being three settings of seven retorts at Annfield Plain and two settings of five each at Dipton. There was a great desire for gas in the portions of Tanfield which were not yet served; and the main needed to connect up this district would be about a mile long and 6 inches diameter. The cost would be about £500. More than double the interest on this sum would be saved from shutting down the Busty Bank works, and supplying the gas from Dipton—in fact, the whole cost of wages and works and repairs at the northern works would be saved. He would bring the whole thing into one undertaking, and supply from a central station. At Annfield Plain there were 20 retorts. The purifiers were very small and old-fashioned; but new ones had been ordered. The gasholder capacity was also small; but the scrubber was quite sufficient for present purposes. The mains actually laid were some 8000 yards in length, and varying in diameter from 5 inches down to 3 inches. At Dipton there were 10 retorts; and, with the exception of the purifiers and tbe gasholder, everything was large enough. The output at the combined works he estimated at 125,000 cubic feet per day, or about 25 millions per annum. It was tbe intention of the promoters to have two new purifiers 10 feet square at Annfield Plain, and two others at Dipton, with the idea in future of putting the whole four down at Dipton. By this means pure gas would be obtained and the cost of manufacture reduced. He considered that the price to be paid for the Burnopfield Gas Company's undertaking (£2350) was very reasonable. The other undertakings were to be acquired by arbitration, and nothing could be fairer. Within a couple of years they would have taken up the whole output, which would amount to between 20 and 30 million cubic feet a year; and new works would then have to be constructed at Dipton. But he would not be surprised if, within another fifteen years, tbe output was 50 or 60 millions. The capital would last about twelve years. The standard price to be cbarged was a reasonable sum.

Mr. *H. E. Jones* said that no two gas-works, each on a scale of only about 5 million cubic feet per annum, which constituted small village gas-works, could be built for less than about £1000 or £1200 per million cubic feet of gas output. It had been reported to him that the sale of gas in the two undertakings was about 9 millions per annum; and the works to provide and convey this to the consumers' houses could not possibly exist or be brought into existence by an expenditure of less than close upon £10,000. When building large works, such as those in London, he spent £400 per million cubic feet; but when putting up medium-sized works, such as those at Eastbourne, Canterbury, or Faversham, he spent £600 per million. When he came to something like 10 or 12 millions, he did the work for £700 per million feet; and if he was providing for only 5 millions, it would take £1000 per million. If he were to go below 5 millions, it would cost £1200 per million as the bed-rock cost for putting in brickwork, gasbolders, cast-iron mains in the streets, and service-pipes. If the slot-meter system were used, a heavier expenditure than the one he had given was demanded.

Rev. *Richard Tewson*, Vicar of Dipton, said that during his 24 years residence at that place be had experienced a great deal of trouble and inconvenience with regard to the supply of gas. In fact, a few years ago they had to go to the expense of buying lamps for the purpose of lighting the church. The supply frequently failed; and the quality of the gas was very poor. Since the new Company had taken over the works, there had, however, been considerable improvement both in quality and pressure. The Local Authority bad not been very active in dealing with the matter; and until the opportunity had gone, they had not disturbed themselves.

Mr. *Redican*, Assistant Gas Engineer to the North-Eastern Railway, said the Company consumed 10 to 12 per cent. of the make of gas at Dipton and Annfield; their annual consumption being some 800,000 cubic feet. He agreed that the quality of the gas had much improved recently.

Mr. *M. M. Hobson*, a resident in the district of Tantobee and Annfield Plain, preferred that the gas undertaking should be in the hands of a statutory Company rather than in those of the Local Authority. He was a Director of the old Company; and when the undertaking was sold, tbey received £10 for their £5 shares. The last dividend they paid was 7½ per cent.; and they could have paid 15 per cent.

Mr. *Braidford*, a colliery manager of Tanfield, said there were 200 houses in his charge that required a gas supply; and the population of the area which was to be included under the Bill was over 4000.

Thursday, June 27.

Mr. *J. A. Castle*, a resident in the district, said his drapery establishment was formerly frequently plunged into darkness through failure of the gas supply; and, in consequence, he was compelled to light his premises with oil. Since the undertaking changed hands, matters had been considerably improved.

Mr. *C. L. Ireland*, the Manager of the Company, said the reason they were unable to supply gas was because they were not permitted to lay mains. They secured customers; but then they found they were unable to supply, because of the action of the Local Authority.

This concluded the case for the promoters.

Mr. *Corbet Woodall*, for the petitioners, said he had visited the district in which the works were situated. After the Bill was in the other House, it turned out that the districts of Tantobie and Tanfield were part of the area of an existing statutory undertaking; and they were thereupon abandoned. The works, when he saw them, were in a very deplorable condition. The maximum day's work done at Dipton—the maximum quantity of gas sent out from the station—was 18,300 cubic feet. The gasholder would only contain 9300 cubic feet. At Annfield Plain, the maximum quantity sent out was 46,000 cubic feet; and the holder capacity was 24,000 cubic feet. At Dipton, there was no washer, no scrubber, no exhauster, and only two purifiers; and under these conditions it was absolutely impossible the gas could be reasonably purified. The retorts at Annfield Plain were in ruins—practically falling to pieces; the purifiers were completely worn out; the connections were 4 inches in diameter, instead of about 6 or 8 inches; and there was no station meter. But apart from this, the whole condition of the place was deplorable, and completely neglected.

In reply to Mr. TALBOT, who drew attention to the fact that £10 was paid for each £5 sbare, and that one of the witnesses had spoken of a dividend of 15 per cent., witness remarked that the payment of dividends under such circumstances was foolish; and it was scandalous to leave the manufacturing plant in such a condition that they could not possibly supply reasonably good gas. The gas must have been deficient in quality; and to be paying dividends, was a thing that ought to have been unheard of. If provision was now made for trebling the output from the present works, he did not think it was a case in which the Company should be allowed such a large amount of capital as would keep them away from Parliament for a considerable time. The idea of doing away with the Annfield Plain station, and concentrating the works at Dipton, was a good one; and he considered that £6000 would fully cover the cost. If the dividend was to be 7 per cent., the standard price of gas ought to be 3s. per 1000 cubic feet; but if the dividend was to be 5 per cent., the standard might be 4s. It was provided that the remuneration of the Directors was not to exceed £250; but if the expenditure generally was to be upon the same scale, there would not be very much dividend to distribute. It was an absurdly extravagant amount.

Cross-examined by Mr. HONORATUS LLOYD, witness agreed it was desirable that the gas should be supplied under statutory powers of restrictions. There was no reason why the Company should not make gas and distribute it at a cost of 1s. 8d. per 1000 cubic feet; and if 1s. covered the dividend, this would make the delivered price 2s. 8d. In cases such as this, the capital allowed by Parliament was never supposed to include anything for goodwill or prospective profits.

Mr. TALBOT, in addressing the Committee on behalf of the Annfield Plain Urban District Council, said the effect of a Bill of this kind was to give the promoters a practical monopoly of the gas supply in the district. Parliament ought to look with far greater jealousy upon the capital arrangements of companies of this sort than upon those which merely invited the co-operation of the public in an adventure, and to see that the public should not be misled by false or fraudulent statements. Here the whole case was an attempt to oust the principles upon which Parliament ordinarily acted in what was a perfectly familiar proceeding—viz., the clothing with statutory powers of undertakings which had hitherto carried on the manufacture and sale of gas without parliamentary authority and merely by the goodwill of the district. There was no dispute between the parties with regard to these principles; but the effect of the Bill was that hereafter any non-statutory company had merely to obtain a purchaser, who would then fill the part of vendor to a new company, and the whole of these principles would go by tbe board. It was an absolute revolution in the principles which Parliament had hitherto observed in the conversion of non-statutory into statutory companies. There was no precedent, as was admitted, for the arbitration agreement. A capital of £30,000 was a most liberal allowance for the future requirements of the Company; and the £250 for Directors' fees was an unreasonable burden. They did not quarrel with the standard price, assuming that the standard rate of dividend was to be reduced to 5 per cent.

Mr. HONORATUS LLOYD, in replying on behalf of the promoters, said that all he desired in the way of capital was an amount which would enable them to carry on business for the usual twelve or fourteen years; and as to the standard price of 4s., in conjunction with the 7 per cent. standard dividend, he contended that this was not too high.

The Committee decided to allow the Bill to proceed. They were not disposed to make any alteration in the capital, Directors' remuneration, or standard price; but they were of opinion that the price paid by the Company to the present owners of the works should be the actual sum paid by them, *plus* the fair value of all improvements made by them since purchase—this amount to be ascertained by an independent arbitrator.

Mr. FITZGERALD: Might I ask if the Committee have come to a conclusion upon the question of what the standard dividend is to be? The standard price is 4s.

The CHAIRMAN: We wish that to be maintained.

Mr. FITZGERALD: The standard dividend in the Bill is 7 per cent.; and the question is whether it should be 7 per cent. or lower?

The CHAIRMAN: I do not think we wish to alter that.

Friday, June 28.

Some discussion took place to-day between Counsel as to the clause prepared by the promoters to carry out the decision of the Committee; and this was ultimately agreed to. The clause provided that—

The agreement made between the said Albert William Schultz and William Comins, hereinafter called the owners, of the one part and Herbert Thomas Martin of the other part, as set forth in the first schedule to this Act, is hereby confirmed and made binding on the owners and on the Company, as if the Company had been a party to such agreement, and the same had been sealed with their common seal. Provided always that, in regard to the purchase under the agreement set forth in the first part of the said first schedule, the following provision shall apply: (1) The purchase price shall be the total of the actual sums paid by the owners for the lands, gas-works, and property described in Article I. of the said last-mentioned agreement; and the cost and expenses of, and incident to, the acquisitions thereof, together with the fair value of all works executed by the owners since such acquisition, and such purchase price, shall be settled by a single arbitrator, to be appointed on the application of either party within three months after the passing of this Act, by the President of the Gas Institution, in accordance with the provisions of the Lands Clauses Acts.

METROPOLITAN WATER BOARD (CHARGES, &c.) BILL.

The Joint Select Committee of both Houses of Parliament, presided over by Lord CROSS, had this Bill (see Vol. XCVIII. pp. 464, 594, 822) again before them last Tuesday, and concluded consideration of it.

Mr. HONORATUS LLOYD, for the Water Board, asked for the insertion of the words "in the case of any supply exceeding 25,000 gallons;" the object being that as other provisos enacted that there should be a minimum of 25s. per quarter charged, unless they put in these words the clause would have the effect of destroying the 25s. minimum.

Mr. MORTEN, on behalf of West Ham, said he objected to the clause as it stood, because the schools which took a supply of less than 25,000 gallons would not be entitled to any supply at all under the Bill. This was altered by the promoters, when they saw the difficulty, by saying they should have a minimum of 25s.; but in many of their schools they did not take 25,000 gallons a quarter. They objected to any provision which would make them pay for more than they took.

Mr. HONORATUS LLOYD said the 25s. minimum had been agreed; and they did not seek for a moment to disturb it.

Mr. HARPER also objected to the words, on the ground that they would create a conflict between certain sections of the Bill. Taking the case of a man who used 26,000 or 27,000 gallons; 26,000 gallons came out at £1 3s. 10d. on the 11d. scale, and 27,000 gallons came out at £1 4s. 9d. They were not entitled to charge him more; but he had to pay a minimum of 25s., and the two things did not appear to fit. It seemed desirable to leave the clause as it was.

The CHAIRMAN, after further argument, said the Committee thought the proposed amendment was right; and it was inserted.

The following Treasury clause was inserted, dealing with charges for supply to Government buildings:—

If, in relation to the charge made, or proposed to be made, by the Board for a supply of water, either for domestic purposes or for purposes other than domestic, to any building for the time being in the occupation of His Majesty, or of any department of His Majesty's Government for public purposes, any question shall arise between the person or department having the control of such building or requiring such supply on the one hand, and the Board on the other hand, as to whether the Board are for the time being furnishing in like circumstances to any other building within the limits of supply for the like purposes as those in respect of which such question arises, a supply of water at a lower rate of charge than the charge so made or proposed to be made by the Board, such question shall be determined by an arbitrator to be agreed upon between the parties to such question, or, failing such agreement, to be appointed on the application of either of such parties by the President of the Institution of Civil Engineers, and subject to the foregoing provisions of this section the provisions of the "Arbitration Act, 1899," shall apply to such determination.

The following Treasury clause was also inserted:—

The rate for the supply by the Board of water for watering any of the Royal parks or gardens situate within the limits of supply and maintained out of the public funds, and the roads in any such parks and gardens, shall, notwithstanding any other provision of this Act, be the fixed rate of 6d. per 1000 gallons.

The preamble of the Bill was then declared proved.

The Action by Messrs. Gibbons Bros.—In this action, which was reported last week (p. 1008), liberty to appeal has been granted by Mr. Justice Grantham, on condition that the defendants pay into Court the money sued for, together with the costs. His Lordship thought that it would be better for the legal points raised in the case to be argued before the Court of Appeal than before him, as he had perused all the authorities cited, and considered the points were for a higher Court.

MISCELLANEOUS NEWS.

EDINBURGH AND LEITH GAS COMMISSIONERS.

The Annual Accounts.

As stated shortly in the last number of the "JOURNAL," the accounts of the Edinburgh and Leith Gas Commission for the year 1906-7 were laid upon the table at a meeting of the Commissioners on Monday, the 24th ult.—Provost MACKIE, of Leith, presiding.

Mr. John S. Gibb, the Treasurer, in submitting them, pointed out that the accounts were subject to audit. He also presented a note, which, he said, brought out, in a few words, the exact position of affairs. It was as follows:—

The balance carried to the profit and loss account on the year's working is		£102,120
There has been paid during the year—		
For Edinburgh and Leith annuities	£31,758	
,, Edinburgh-Portobello annuities	1,070	
,, Amount transferred to sinking fund in respect of annuities redeemed	2,372	
,, Do. in respect of mortgages redeemed	637	
,, Interest on mortgages, &c.	42,083	
,, Expenses of mortgages	910	
		78,830
Showing a net balance on the year's working of		£23,290
From this falls to be deducted the debit balance for the year to May 15, 1906 (after meeting the sinking funds contributions for that year)		406
Making the sum at the credit of the profit and loss account		£22,884

As compared with £18,898 for the previous year.

This is subject to the statutory minimum charges for the sinking funds, as follows:—

(1) For repayment of money borrowed (20s. per cent.)	£11,918	
(2) For redemption of annuities (15s. per cent.)	6,944	
(3) For reserve fund (Commissioners' Gas Order, 1902, sec. 9), ¾ per cent. on £444,228	1,110	
		19,972
Which leaves a balance of at the credit of the profit and loss account, to be carried forward to next year.		£2,912

Under the "Law Expenses" and "Accidental Damages" accounts, provision has been made to meet Lord Ardwall's decision in the brewery well case.

The gas sold has been 86 million cubic feet more than last year; and the revenue from gas is greater by £11,769. The return from residual products has also been larger by £5752 than last year.

The present value of 1d. per 1000 cubic feet is £7952 5s. 9d.

On the motion of the CHAIRMAN, who expressed gratification at the result of the year's working, the accounts were remitted to the Finance and Law Committee to be dealt with.

The CHAIRMAN said that, as the Commissioners were aware, they delayed the settlement of their coal contracts, as they were of opinion that the market might become somewhat easier. He thought they should not delay further, because it was getting on in the season. They should advertise at once, and secure what they required for the coming year.

This was agreed to.

The accounts show that the stock capital, which originally stood at £370,000, with annuities to the amount of £35,200 payable thereon, has been reduced to £344,518 by the redemption of annuities, of which £103 of annuities were redeemed last year, at a cost of £1061. The loan capital authorized amounts to £1,400,000. There has been raised, by mortgage, £994,418, and borrowed upon deposit receipt £197,393; making together £1,191,811. Mortgages of £52,417 have been redeemed out of sinking fund, which has the effect of cancelling borrowing powers to this amount. That sum added to the mortgages and the amount in the deposit receipts, raises the loan capital to £1,244,228, and leaves a balance of borrowing powers of £155,771. The loan capital was increased during the year by £117,272. The capital expenditure amounted to £83,276, of which £72,784 was in connection with the Granton works, £5102 upon main and service pipes and the cost of laying, £1679 upon gas-meters, £2587 upon heritable properties not embraced in the works, and £1123 upon cooking and heating stoves. The capital expenditure was £16,617 less than the previous year.

The total revenue amounted to £325,222; being £17,647 above that of the preceding year, and £16,369 above the estimate adopted in September last. The quantity of gas sold was 1,931,301,000 cubic feet, or an increase of 86,141,100 cubic feet. The revenue from gas was £265,181, an increase of £11,769; from coke £24,632, an increase of £5748; from tar £13,412, a decrease of £580; and from sulphate of ammonia £21,145, an increase of £584.

The total expenditure was £223,102; being £6875 more than in 1905-6, and £9330 more than the estimate. The coal carbonized was 178,524 tons; being an increase of 7226 tons upon the previous year, and of 3524 tons upon the estimate. The cost of coal was £104,000, an increase of £168, but less than the estimate by £513. Oil for carburetted water gas cost £2800, a decrease of £475 upon the year, and of £983 upon the estimate. Salaries and wages amounted to £25,372, an increase of £2186 upon the year. Purifying materials and wages of purifier men came to £1851, a decrease of £64. Repairs and maintenance of works and plant, tools and implements, and dismantling old works, cost £24,254, a decrease of £1214. The total cost of the manufacture of gas was £158,278, an increase of £3030 upon the year, and of £384 upon the estimate. Distribution of gas cost £24,936, an increase of £348 upon the year, and of £850 upon the estimate; it being

almost entirely upon the repair and maintenance of meters. Management cost £10,654, an increase of £436 upon the year, and of £104 upon the estimate. Feu-duties, rents, rates, and taxes amounted to £15,118; being a decrease of £1301 upon the year, and of £482 upon the estimate. Pensions and allowances were paid to the amount of £1541, a decrease of £246 upon the year, and of £159 upon the estimate. Accidental damages, £3770 (the amount of the award in the well case), were up by £3727; and law and parliamentary charges £1891, were also up by £125 due to the same litigation. Discounts, abatements, and bad debts amounted to £6912, an increase of £756.

The sinking funds amount to £169,485, of which £165,770 is invested over heritable properties, and £3715 is lying in the bank on deposit receipt. These funds are less than they were a year ago by £6833; the charges being now heavier upon them on account of the increase of capital. The sinking fund for the repayment of money borrowed stands at £33,790; and that for the redemption of annuities at £135,695. The reserve fund—£7839—was increased during the year by £1170. The fund is now in the bank, on deposit receipt; whereas a year ago it was invested in mortgages over heritable properties.

Gas-stoves were purchased during the year to the amount of £2517, which was £455 more than was expended for the purpose in the preceding year. The expenses incurred in repairing and fitting up stoves amounted to £3474, a decrease of £341. The amount received for the hire of stoves was £1763, a decrease of £1700, which was due to the reduction by the Commissioners in July last of the rates for hire. For stoves sold, there was realized a sum of £1473, an increase of £125. For the fitting up of gas-fires there was received £603, an increase of £110. The proportion of fittings charged to the revenue account was £1029, or £12 less than before. The total expenditure on stoves and on repairing and fitting was £5991; and the total receipts for hires, sales, and fittings up was £3839. If to this sum is added the £1029 (the proportion of fittings charged to revenue account), the total revenue is brought up to £4868, which is less than the outlay by £1123, which again exactly corresponds with the amount by which the stock of stoves, &c., on hand or lent on hire, at the 15th of May exceeds in value that stated at the corresponding period of last year.

ANNUAL GAS REPORTS AT NOTTINGHAM.

Reports have been prepared for submission to the City Council by the Nottingham Gas Committee and Mr. J. H. Brown, the Engineer and Manager, on the working of the undertaking during the twelve months to March 31.

The Committee's Report.

In their report, the Gas Committee state that the quantity of gas sold during the year was 1,927,953,600 cubic feet, against 1,917,696,300 cubic feet in the previous year; being an increase of 10,257,300 cubic feet. The total income for the year amounted to £325,235, and the expenditure to £219,483, leaving a balance carried to the profit and loss account of £105,752. After deducting the interest, annuities, and sinking funds, and placing £2000 to depreciation of stoves, there remained a net profit of £50,303 at the disposal of the Council. Of this sum, £27,000 was to be handed over to the Finance Committee, by order of the Council, in aid of the general district rate; and the Committee recommended that the balance of £23,303 be disposed of as follows: £3000 to the depreciation fund, and the balance, £20,303, to the reserve fund and to meet the extra expenditure during the current year for repairs to the works and plant. Repairs estimated to cost £8000 had been already passed by the Committee for the Eastcroft works; and others were also being carried out at the Basford and Radford works that were estimated to cost £8000 and £2000 respectively.

The Gas Engineer's Report.

In his report, Mr. J. H. Brown, the Engineer and Manager, said that the reconstruction of the retorts in No. 1 retort-house at Eastcroft, which was to have been undertaken early in 1906, had now been commenced; and half of the house would be ready for work during the coming winter. The remaining half was being temporarily repaired until next spring. The new settings in the inclined retort-house were put to work last autumn, and had given very great satisfaction. The emergency value of this new plant had been of very special value during the past winter. The remainder of the work required to be done in the house was commenced this spring, and was nearing completion. At the Basford works, the new (fourth) section in the No. 3 house was put in operation last autumn, and had now had more than six months' continuous work. The results obtained had been very satisfactory. The new design was a considerable advance on the other three sections. The No. 1 and No. 2 sections in this house, which were to have been rebuilt in the spring of 1906, owing to delay had had to be reset with new retorts and repaired. The retort-beds in No. 1 and No. 2 houses were being repaired and refurnaced where necessary. This plant was not of modern design, but gave satisfactory results for the short period it was usually required to work during the winter months. The erection of the water-gas plant was finished early last year; but it had not yet completed its trial runs. It was most desirable that this plant should be thoroughly tested and made ready for efficient work in case of emergency. At the Radford works, the carbonizing plant was rapidly nearing the end of its useful life. For many years past, it had been used solely for work during mid-winter, or in case of emergency. So long as the existing plant was capable of giving fairly satisfactory results for the short period it was required to work, it would not be desirable or economical to incur the increased charges for interest on capital which would be involved by the substitution of new and modern plant. If allowance were made for the increased efficiency of the modern plant, such an expenditure could not even then be justified. The existing retorts were being repaired and made ready for the coming winter. The amount shown in the accounts for repairs and maintenance of works, &c., for the year was £34,243. The expenditure under this head had been above the normal for the past five years; and though a reduction was made last year, the sum shown in the accounts (which included £3000 in anticipation of next year's expenditure) was equivalent to 4¼d. per 1000 cubic feet of gas sold.

The reorganization of the distribution system, which was first commenced in 1903, was practically completed last autumn. During the past winter, the whole of the gas area was divided into sections, each works supplying its own district. A great improvement had been effected, and better and more efficient control could now be maintained on the pressure of gas throughout the whole of the city area. The department continued to suffer considerable loss from leakage, owing to the scattered nature of the area supplied. Substantial improvement was shown in the first three quarters of the past year; but this had been more than counterbalanced by the last quarter. The loss was largely due to subsidences which took place after the wet season.

The coke available for sale per ton of coal carbonized showed an increase of ¾ cwt. (or 6962 tons). This saving was largely due to the better working of the new settings and the carbonizing plant generally. Owing, however, to the fall in the value of coke during 1906, the net receipts were only £717 more. The tar-plant had been kept in an efficient state of repair, and a larger quantity had been distilled than in any previous year; the receipts being £2527 more than in the previous year. The sulphuric acid plant had been maintained in good working condition, and satisfactory results obtained during the past year's working. The sulphate of ammonia plant at Basford had manufactured more sulphate than in any previous year; but unfortunately, owing to the reduced value of the sulphate, the receipts were less by £463.

The increase of 0·53 per cent. in the quantity of gas sold was very satisfactory in view of the rapidly extended use of incandescent gas-burners. This was again evidenced by the result shown by the Public Lighting Department. Notwithstanding the constant increase in the number of public lamps, the consumption of gas had shown a regular decrease during the last five years, owing to the introduction of the incandescent system of lighting; but now that the system was practically universal throughout the district, a slight increase was shown in the consumption. The figures were sufficient to demonstrate the economical advantage derived from the incandescent burner; and doubtless but for the general introduction of these burners, the output of gas during the past few years would have shown a very considerable increase. In the past year, the difficulty experienced in the application of incandescent lighting to lace machines had been satisfactorily overcome; and there were at least three factories where this system was being applied with exceedingly satisfactory results.

During the year, 189,576 tons of coal had been carbonized, yielding 2,060,625,000 cubic feet of gas. The number of cubic feet of gas sold per ton of coal was 10,170. Carbonizing costs per 1000 cubic feet of gas sold had increased from 2·67d. in 1906 to 3·01d. in 1907; the increase being largely due to the additional cost of manufacturing a higher candle-power gas. The amount paid for rates and taxes (£16,835) showed a further increase of £1033. The previous year was an increase of £1130 as compared with 1905.

The amount of gross profit each year from 1902 was as follows:—

1902	£75,907
1903	89,141
1904	97,037
1905	91,941
1906	101,221
1907	105,752

Special attention was called to the average price obtained per 1000 cubic feet of gas sold, which had risen in the past year to 2s. 6·05d. from 2s. 5·82d. in 1906. The same prices for gas were in operation during 1907 as in 1906. The rise in the average price obtained, of 0·23d. per 1000 cubic feet of gas sold, was due to the increased proportion of prepayment meters, which now consumed nearly 300 million cubic feet of gas—an increase of about 30 millions for the year. The price to prepayment meter consumers included a further charge of 10d. per 1000 cubic feet for the rent of meter and cooker, and for the increased cost of the service generally. The average price per 1000 cubic feet of gas sold, after deducting this extra charge for rent, was 2s. 4·5d. The number of complaints received during the year (excluding those due to deposits of naphthalene) was 25·96 per cent., against 27 86 per cent. in the previous year.

The total mileage of mains was 364·88. There had been 8·01 miles added to the canalization during the year. The number of meters fixed at March 31 (including 453 lamp-meters) was 66,845; being an increase of 3106 on the previous year. The demand continued for prepayment or "penny-in-the-slot" meters. At the end of the financial year, 26,623 of these meters were in operation; an increase of 2870 on the previous year. The application of gas for trade and domestic purposes, other than for lighting, continued to increase. There were at present in use: Gas cooking-stoves, about 27,663; gas-fires, about 13,033; gas-engines, about 663; and a very large number of other appliances of almost every description, which had not been numbered. Of the 27,663 cookers in use, 9630 were rented from the department, and 17,331 were supplied with automatic meters rent free.

COVENTRY CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The detailed statement of the Gas Committee of the Coventry City Council, relative to the working of the Gas Department in the year ended the 31st of March, has been issued. The total borrowing powers exercised since the acquisition of the undertaking amount, with nominal additions, to £426,308, of which £31,340 has been repaid out of the sinking fund. The present liabilities are therefore £394,968. Against this the Corporation have reserve and sinking funds invested amounting to £42,278; leaving a balance of liability of £352,690. The amounts expended during the year on capital account were as follows: Structural works (Foleshill site), £18,638; new mains and services, £3600; new meters, £1819—total, £24,057. The total capital expenditure since the acquisition of the undertaking, including the original purchase-money, amounts to £354,236. The balance of capital

in hand is £72,071. The total revenue for the year from all sources amounted to £119,309; and the expenditure to £99,014. This leaves a gross profit of £20,295, to which has to be added the amount carried forward from last year and the interest allowed by the bank and the Barnsley Corporation—making a total of £22,919. Against this are capital and other charges amounting to £19,427—leaving a final balance of £3492. The amount of the reserve fund is at present £9665. With regard to the disposal of the profit balance, the Committee recommend that £2000 should be paid over to the district fund, and the remainder (£1492) carried forward.

OLDHAM CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The General Manager of the Oldham Corporation Gas Department (Mr. Arthur Andrew) has prepared his customary report on the working for the year ending the 25th of March.

The total expenditure on capital account in the twelve months reported upon was £6232; the largest amount (£4079) being at Hollinwood. The gross revenue amounted to £167,772, and the gross expenditure to £130,518; the balance carried to the profit and loss account being £37,254. Deducting from this the annuities during the year (£3378), interest on loans and stock (£12,875), and sums payable to the respective sinking funds (£4512), there is a net profit of £16,489. Adding the balance brought forward and one year's accrued interest from the annuity redemption fund, and deducting the amount to which the Corporation are entitled in aid of the borough fund (£8515), and £8000 for the reserve fund, the credit balance to be carried forward is £14,507. The gross profit is £3502 less than that of the previous year. This is entirely due to the reduced price charged for gas since June 25, 1906, and to the cost and maintenance of consumers' meters, which is now borne by the department, instead of by the owners as formerly. The average price realized for coke was nearly 3d. per ton more than in the previous year; and on tar there was a gain of 4¾d. per ton. A slightly less price was received for ammoniacal liquor. On the expenditure side of the revenue account, the cost of coal, oil, &c., was rather less than in the preceding year. The amount expended under the head of mains and maintenance of works and plant has increased to the extent of £1232. Carbonizing wages have, however, decreased by £1279, though 5497 tons more coal were carbonized. This saving is due to the more extended use of stoking machinery. A sum of £580 has been paid in respect of compensation to injured workmen. This is quite exceptional, and is much larger than in any previous year. Taking an average of years, the policy pursued, of accepting the risk without insuring, has been an economical one. The cost of fixing cookers free during the year amounted to £1177. The average price realized for gas sold, including gratuitous lights, during the year was 23·67d. per 1000 cubic feet. This is the first time the figure has fallen below 2s. A sum of £1500 has been transferred from the reserve fund to the credit of capital account for depreciation of cooking-stoves. The amount in the reserve fund on March 25 was £48,986.

The quantity of gas supplied to the corporate street-lamps and municipal buildings free of cost during the year was 83,871,000 cubic feet. There were 59 additional lamps erected within the municipal borough, and 22 in the out-townships. The total number of lamps fixed in the supply district on the 25th of March was 5436. The total number of incandescent lamps at that date was 1638 within the borough, and 614 in the out-townships; being an increase of 417. Automatic controllers have now been in operation for over twelve months on 109 lamps; and so far they have proved very satisfactory. The quantity of gas manufactured at the different stations during the year was: Oldham, 99,211,000 cubic feet; Higginshaw, 697,549,000 cubic feet; Hollinwood, 458,017,000 cubic feet, ditto (water-gas plant) 109,749,000 cubic feet; Royton, 49,439,000 cubic feet—total 1,413,965,000 cubic feet, against 1,318,944,000 cubic feet in the preceding year, being an increase of 94,571,000 cubic feet, or 7·2 per cent. The quantity of coal carbonized was 115,867 tons; and 369,453 gallons of oil and 62,146 gallons of benzol were used in gas production. The average quantity of coal gas made per ton of coal carbonized was 11,256 cubic feet, compared with 11,010 cubic feet in the previous year. The loss of gas from leakage, &c., was 80 550,000 cubic feet, or 5·69 per cent. of the quantity made, compared with 5·82 per cent.

The total number of meters fixed on the 25th of March was 50,723, of which 1068 are of the prepayment type. There were 547 meters fixed in new premises and others in which gas had not previously been used; and 583 meters were disconnected and the services taken out where gas is not likely to be required in the future. The actual number of consumers on March 25 was 44,862. The number of additional cooking-stoves and grillers fixed during the year free of charge to consumers was 1333. The total number in use on the 25th of March was 10,575. During the year 44 gas-fires, &c., were sold.

The increase in the quantity of gas consumed by private consumers, excluding gratuitous lights, was 87,139,000 cubic feet, of which there was consumed in houses and shops 46,670,000 cubic feet, and 40,469,000 cubic feet in mills and works; the greatest increase in the last-named being in machine shops and kindred trades. There was, however, a substantial increase in the quantity consumed in the textile mills. Previously there had been a decrease in the consumption in this class of property, owing to the extension of the incandescent system of lighting and the installation of electricity. In order to supply the increasing consumption in the district of Royton, a 24-inch main is now being laid from Middleton Road, Chadderton, to Royton, which will suffice for the needs of the last-named township for many years to come. It is probable that the works at Royton will not be again utilized for the purpose of gas manufacture. A great amount of trouble and annoyance has been caused during the past year by the accumulation of naphthalene in the mains, service-pipes, and meters of consumers. Steps have, Mr. Andrew remarks, been taken, by the laying down of special plant, for the elimination of this troublesome substance from the gas during the process of manufacture; and it is confidently hoped that the means adopted will prove successful.

Contracts have been entered into during the year for replacing a further number of old retort-settings at the Hollinwood station with others on the regenerative principle, and also for extending the plant for charging and drawing by machinery, and for the automatic conveyance and storing of coke. A plot of land has been acquired at Hollinwood, within the Oldham boundary, on which to erect an additional gasholder; the largely increasing requirements of the district necessitating increased storage accommodation.

SATISFACTORY RESULTS AT SKIPTON.

At the last meeting of the Skipton Urban District Council, the results of the past year's working of the gas undertaking were placed before the members.

The statement was made by the Chairman of the Gas Committee, Mr. Graham, who said that during the twelve months to March 31, 7702 tons of coal had been carbonized, as compared with 7394 tons in the previous year—an increase of 308 tons. The gas sold had been 77,484,000 cubic feet against 72,067,000 feet. There had thus been an increase of 5,417,000 feet, or 7 per cent. The make of gas per ton of coal had been 10,060 cubic feet, against 9746 feet. These matters were very satisfactory. Last year, in his statement, he spoke of the leakage, and the saving that had been effected since the Council took over the concern. He then announced that they need not expect any further economy in the way of leakage prevention, seeing that they had reduced the figure to 4·36 per cent. They had, however, done better; and the leakage had been reduced to 3·2 per cent. This was a remarkable achievement, having regard to the small size of the community with which they had to deal. Gas-rentals had increased £77, from £10,177 to £10,254. They must remember, moreover, that during the year they reduced the price of gas 2½d. per 1000 cubic feet to ordinary consumers and 3d. to slot-meter consumers. The growing popularity of the slot meter had been proved; and of these consumers during the year there had been an increase of 222. There had, however, been a decrease of 106 ordinary meter users; leaving the net increase in consumers for the year 116. During the year, 238 gas-cookers had been fixed, making the total number in use in the town 1033. It was reasonable to expect that, if in the near future there was to be a further reduction in the price of gas, it would be the result of people being encouraged to use more gas for cooking purposes. They must also bear in mind that this year the price of coal had gone up 6d. per ton—a fact that militated against their gross profits. The cost of coal, after deducting receipts for residuals, would work out on this occasion at 3s. 2d. per ton; and last year it was 2s. 11½d. per ton. The gross profit had been £5548, against £5697, a reduction of £149. The net profit for the past year was £950; and in the preceding year it was £1142. They had reason to congratulate themselves on the management and the result of the year's working; and congratulations were due to Mr. J. H. Woodall, the Engineer and Manager, and to his staff for the effort they had put forward and the success achieved. They were often hearing rumours about gas-works extensions. For his own part, he saw no necessity for extending. If they made the best use of their resources, they had ample plant to serve the purposes of the town for many years, unless they were faced with an extraordinary demand for gas.

THE YEAR'S WORKING AT SMETHWICK.

The Secretary's Report.

The Smethwick Town Council, at their meeting last Tuesday, had before them the accounts of the Gas Department; and they approved of the Committee's recommendation that £2000 should be allocated in relief of the general district rate, £1000 be paid as the second instalment of their contribution of £5000 towards the cost of the new Council House, and £5961 be carried to the depreciation and suspense account.

In his report upon the accounts (which are for the year to March 31), Mr. W. J. Sturges, the Secretary of the Gas Department, states that the borrowing powers remain as before; no additional capital having been raised during the year. The net debt, after deducting the amount in the sinking fund, stands at £155,725. The capital outlay during the year was £6615, of which £5064 was incurred on account of the railway bridge and sidings, and £1551 for new meters. The total expenditure to the end of the year (after writing off £4521 for depreciation) was £218,324, or equivalent to 10s. 6d. per 1000 cubic feet of gas sold, as against 11s. the previous year. Satisfactory progress is again shown in the sales of gas. Following upon an increase of nearly 13 per cent. in the preceding year's output, there was in the past twelve months an increase of 5·65 per cent. (representing 22,193,600 cubic feet) in the quantity of gas sold. The total amount of gas sold and accounted for during the year was 415,116,300 cubic feet, and the quantity unaccounted for was 20,267,700 cubic feet, or 4·65 per cent. of the gas sent out, which was the same percentage as in the previous year. The number of ordinary meters in use at the end of the year was 3478, an increase of 107; and the prepayment meters numbered 6119, an increase of 637. The aggregate number of meters of both classes was 9597, against 8853. There were also on hire and in use 962 cooking-stoves.

The income derived from the sale of gas, after allowing for discounts and adjustments, amounted to £47,036, or an increase of £1994. The reduction of 2d. per 1000 cubic feet in the price of gas to small consumers absorbed over £500. During the year 66,748 collections were made from prepayment meters; and the cash taken therefrom was £11,671, of which £534 was returned as discount to the consumers. Residual products brought in £539 more than in the previous year. Coke and breeze produced an increase of £722, due to the larger quantity sold; while, on the other hand, tar and ammoniacal liquor together realized £183 less, owing to a falling off in the yield of tar and in the market value of ammonia. The total income from all sources was

£61,353, as compared with £58,845, or an increase of £2508. The expenditure on the year's trading was £41,917, against £40,768, or an increase of £1149. The total charges for manufacturing, including maintenance and renewals of works and plant, amounted to £32,956, or an increase of £841. The gross cost per 1000 cubic feet of gas made works out at 1s. 6·179d., as against 1s. 6·695d., equal to a saving in favour of last year of ½d. per 1000 cubic feet in cost of production.

The average cost of coal used (including all handling charges) was 4½d. per ton lower than the previous year; and the total quantity carbonized was 35,483 tons, yielding 414,466,000 cubic feet of gas, or an average of 11,680 cubic feet per ton of coal, against 11,485 cubic feet per ton the previous year. The quantity of coke used for the manufacture of water gas was 329 tons, producing 20,646,000 cubic feet of water gas, or 62,753 cubic feet per ton. The total quantity of gas made therefore was 435,112,000 cubic feet, an increase of 22,829,000 cubic feet, or 5·54 per cent. There was an improved yield in the quantity of coke produced per ton of coal, a slight falling off in the yield of tar and ammoniacal liquor, and a considerable saving in the quantity of coke used for heating retorts, steam-boilers, and other manufacturing purposes. The cost of distribution, including maintenance and renewals of mains, services, and meters, and also fittings for prepayment installations, shows an increase of £98. The total mileage of mains at March 31 was 48; and the quantity of gas sold per mile of main was 8,648,256 cubic feet.

The gross profit on the year's trading amounted to £19,436, equivalent to 11·237d. per 1000 cubic feet sold, compared with £18,077, or 11·042d. per 1000 feet, for the previous year—an increase of £1359, representing a return of 9·75 per cent. on the outstanding capital debt, as against 9·03 per cent. for the previous year. The balance standing to the credit of this account at the commencement of the year was £7109, to which has been added the gross profit of £19,436, giving a total credit balance of £26,545. The charges in respect of interest on loans and the annual instalments to sinking fund for redemption and extinction of debt, amounting to £10,474, having been fully provided for, the surplus remaining as the net profit for the year is £8961, as compared with £7807, an increase of £1154. After contributing the sum of £2000 to the district rate, the second instalment of £1000 on account of the sum of £5000 towards the cost of erecting the new Council House, and transferring £5961 to the depreciation and suspense fund account, the balance of profit remains the same as at the start of the year—£7108.

In expressing the hope that the results of the year's working would be considered satisfactory by the Gas Committee, Mr. Sturges points out that an increase of 5·65 per cent. in the output has enhanced the amount of net profit 14¾ per cent., as standing charges and interest on loans and redemption of debt are not appreciably higher. There is as yet no falling off in the applications for prepayment-meter installations; and gas for power purposes, competition notwithstanding, is still in demand—eleven new accounts having been secured since the last report. The foresight of the Committee in purchasing their requirements of coal for the coming year before the serious advance in prices, has relieved them of the anxiety affecting gas undertakings generally, and in some instances necessitating an increase in the price of gas to meet the extra cost of coal.

LIGHTING THE SMETHWICK NEW COUNCIL HOUSE.

On Wednesday, the 19th ult., the new Council House which has been erected at Smethwick at a cost of £20,000 was opened, with the customary formalities, by the Mayor (Alderman Edwin Adams, J.P.). The event calls for notice in these columns from the fact that the question of the illuminant to be employed gave rise to much debate, and was eventually decided in favour of gas. For the following particulars in regard to the lighting, which was carried out by the Gas Department under the supervision of the Gas Engineer to the Council (Mr. Vincent Hughes), we are indebted to the "Smethwick Telephone." On the opening day, the elaborate gas-fittings, which had nearly all been specially designed to suit the requirements of the building, were greatly admired. They were supplied mainly by Messrs. Evered and Co., of Smethwick; but some fittings were also obtained from Messrs. Best and Lloyd, Messrs. James Milne and Son, the Birmingham Lighting Company, and others.

Dealing with the fittings in detail, special mention must be made of the handsome pair of newel standards which adorn the principal staircase. Each consists of a heavily-moulded base enriched with four dragons, from which rises a centre shaft supporting five arms; the whole being finished in ormolu gilt. Rising as they do from heavy Doulton newel pillars, they have a very rich effect. The Council Chamber has a highly effective scheme of lighting; the whole of the fittings being specially designed by Messrs. Evered to suit the architecture and fitments of the chamber. Hanging from the centre of the dome, there is a large and handsome fitting, carrying 16 lights, arranged in three tiers of ten, five, and one. These are actuated by three of the Pneumatic Gas Lighting Company's switches placed near the door, the tier of ten lights being operated by two, each controlling five alternate lights, and the other two tiers by the third switch. In addition to this centre light, there are lights depending from the cornice from which the dome springs. There are 20 brackets, arranged in sets of five on each side of the cornice, and handsome three-light descending fittings in each corner. The result, when all these lights are on, is extremely brilliant. In addition to the gas lighting scheme in this chamber, there is a secondary one of electric lighting. The whole of the fittings in the Council Chamber are finished in antique copper, the richness of the colour blending very effectively with the dark oak fitments. There is also a four-light gas corona in the reception-rooms on either side of the chamber. They are of similar design and colour to the fittings inside. Most of the offices throughout the building are fitted with productions from Messrs. Evered's works. The greater part of the building has been provided with inverted fittings manufactured by the Ecliptic Gas Light Company; and on entering the vestibule one's attention is immediately directed to the handsome ornamental gas-fittings suspended overhead. Nothing but admiration can be expressed for the corridor lights, the design of which was, it is stated, taken from an old lamp in Madrid Cathedral.

GAS AND ELECTRICITY AT SHEFFIELD.

At the opening of the Twelfth Annual Convention of the Incorporated Municipal Electrical Association in Sheffield last Tuesday, under the presidency of Mr. S. E. Fedden, the General Manager of the Electric Lighting Department of the Corporation, the Lord Mayor (Alderman R. Styring), as is usual on such occasions, offered a few remarks in welcoming the members. In the course of them, he expressed the hope that they would be able to do more than they had done at any previous conference in the way of promoting the great science of electricity, which, in every department, had made startling advances. His Lordship went on to say that in Sheffield they were singularly handicapped, and had to carry on their electrical undertaking under most trying conditions. They had a Gas Company, who, owing to peculiarly favourable circumstances, were able to sell gas at 1s. 2d. to 1s. 4d. per 1000 cubic feet. He did not know any other place where this could be done; but members of the Association would realize that it was a fact of the greatest importance in the carrying on of their electrical undertaking. He should be the last to complain of this cheapness of gas—the citizens got the benefit of it; but it subjected those engaged in carrying on the electrical industry to a severe strain, which was not to be found in other places. The Lord Mayor having been thanked for his welcome, the President delivered his address; and a vote of thanks was cordially passed to him. The mover of this resolution (Alderman Pearson, of Bristol) raised a laugh by alluding to the "abominable fact" that Sheffield had its gas so much more cheaply than other places in the kingdom.

Referring to this portion of the Lord Mayor's address, the "Sheffield Daily Telegraph" last Wednesday said: "We could not help a sympathetic grin as we heard the Lord Mayor's pathetic description yesterday of the multiform evils of cheap gas. It is hard lines on him. Here he is trying hard to sell a 2d. article for 3d., while somebody else is breezily turning it out for 1½d. The Lord Mayor in his private capacity is a Free Trader. To him and his friends cheapness is politically 'the god of their idolatry.' And what he has to do is to produce electricity at a figure that will give us the same light as gas gives us, for less money. If he cannot do that, he goes by the board. Municipal trading must stand or fall by its achievements in the open market. And so far as Sheffield lighting is concerned, gas *plus* private enterprise has, to put it in the common tongue, 'knocked municipalism into a cocked hat.' Is anybody anxious to double his gas bill in order that the Electric Light Committee may make a profit?"

The subject of the competition of gas with electricity in the city came up again at the dinner of the Association on Thursday evening. In proposing "The Incorporated Municipal Electrical Association," Sir William Clegg said the amount of work the Lord Mayor had done in getting the electric light undertaking established was beyond all praise; but they had a private gas undertaking which was a serious competitor with it. The Gas Company was excellently managed, and those in charge of it were imbued with a great deal of public spirit. The undertaking produced gas cheaper, with one exception, than any private or municipal undertaking in the country; and they could not reasonably find any fault with the way in which the undertaking was carried on, though it offered heavy competition to the Electric Light Department. Some of them would, he thought, have to consider seriously what was the wisest course to follow in regard to the Company in the future. It might be desirable to open up negotiations with them with the object of purchasing the concern. If they could agree upon a price, it might be to the interests of the city that they should acquire the undertaking. At a later stage, in responding to the toast of "The Visitors," Mr. J. Dixon, commenting on Sir William Clegg's remarks as to the acquisition of the gas undertaking, said manufacturers would oppose any such step, because healthy competition was a good thing. Moreover, the time for taking over a gas concern had gone by.

SUPPLY OF ELECTRICITY IN LONDON.

Report of the Parliamentary Committee of the County Council.

At the Meeting of the London County Council to-day, the Parliamentary Committee will present a long report dealing with the circumstances which led to the rejection of the Council's Electricity Supply Bill by the Hybrid Committee of the House of Commons, to which reference is made in our "Electric Lighting Memoranda."

The report sets forth at some length the proceedings before the Committee; and the many difficulties which had to be encountered in attempting to meet the views of the Committee with regard to the preparation of a table of conditions to be embodied in any deed for the transfer of the powers to be given under the Bill are reviewed. The Committee state that they were hampered by the difficulty that while, on the one hand, they wanted to meet the views of the Hybrid Committee, yet on the other they wished to avoid tying the hands of the Council in future negotiations. The most important of the new clauses introduced dealt with the general conditions which should govern any assignment of powers sought in the Bill; and in this, the Committee say, they endeavoured to give effect to the Instruction passed by the House of Commons at the instance of the President of the Board of Trade, to the effect that if any power were conferred upon the Council to transfer or lease to any company, local authority, body, or person any of the powers, duties, or liabilities contained in the Bill, the conditions upon which such power should be exercised were to be embodied in that or a subsequent Bill. In preparing the amended proposals submitted to the Hybrid Committee, the effect of the report on the Bill by the Board of Trade was also considered.

The Committee point out that the Bill would have enabled consumers to obtain a cheap supply of electricity without risking any money of the ratepayers' or requiring the credit of the Council to be pledged in any way for the purpose of the undertaking, and that a supply could have been expected under the scheme at prices ranging

from about 1d. to ¼d. per unit; the present average charges throughout the area of supply being about 3d. "The scheme," the report says, "would have conferred a boon not only upon manufacturers requiring a supply for power purposes and householders requiring it for lighting, but also the travelling public, to whom a cheap supply for traction means so much. It is, indeed, difficult to over-estimate the loss which London has sustained by the rejection of the Bill, particularly in regard to the effect upon the trade of London and the employment of workmen and others dependent thereon." On the close of the case for the Bill last Tuesday, the Chairman (Mr. D. A. Thomas) announced that the Committee desired to deliberate, and the next morning he stated: "The Committee find that the preamble of the Bill is not proved, and we will report to the House accordingly." Complaint is made that no opportunity was afforded the Council to consider how far it might be possible to meet objections entertained in regard to the Bill, and that the Hybrid Committee which dealt with it had given no indication as to the reason which led to their decision, nor made any report on the subject which might have served for guidance in the future.

The report concludes as follows: "The only inference we can draw from the action of the Committee is that they thought the Council should itself carry out and find the money for the proposed undertaking, and that there should be no transfer of the powers. This, of course, would have been contrary to the policy to which the Council is pledged, and to the clearly-expressed wishes and mandate of the people of London at the last election. It would have been contrary even to the views of the Finance Committee, who pointed out clearly in their report of Dec. 11, 1906, the risks and speculative character of the enterprise. It would also have ignored the suggestion in the report of the Select Committee of last session with regard to powers of leasing. . . . We should have been ready to consider any suggestion which the Committee might have put forward in order to find at last a solution of this question, which has been so long outstanding; and we gave a proof of our readiness to meet the wishes of the Committee by preparing the new conditions which provided for the purchase in 1931. The experts advise us that one of the results of the loss of the Bill will probably be the growth or extension of small and uneconomical generating stations and undertakings. The prospects of a large and cheap bulk supply, though favourable to-day, must in the near future become hazardous and speculative. Success in this case hinges on the question of time; and we may never be able to retrieve those opportunities which have been so lightly thrown away. The result is that the Council is no nearer a solution of this question, which is admitted on all hands to be one of the utmost urgency; and while left without any guide from Parliament for the future, we are face to face with the fact that apparently Parliament intends in this matter to override the expressed wishes of the people of London."

The Committee think the matter is of such importance that the Council should place on record an expression of their opinion on the subject. They accordingly recommend the adoption of the following resolution: "That, in the opinion of the Council, it is a matter for deep regret that the London County Council (Electric Supply) Bill, 1907, has been rejected, thereby depriving the elected representatives of municipal London of the opportunity of securing the provision of a cheap supply of electricity subject to public control."

Mr. H. H. Gordon has given notice of his intention to move an amendment to the recommendation of the Committee to the effect that, with a view of ascertaining what steps should be taken to place again before Parliament a comprehensive scheme for the development of electricity for London and adjoining districts, the Highways Committee be instructed to convene a conference of the various local authorities concerned, and to report the result of such conference to the Council as soon as possible.

SALE OF COKE AND RESIDUALS IN GERMANY.

The Annual Meeting of the Economic Association of German Gas-Works, which was formed in 1904, with head-quarters at Cologne, was held recently at Mannheim. The main object of the Association is the sale of the gas coke produced by the constituent works; but it is being extended to the disposal of residual products. During the year 1906-7, the number of gas-works belonging to the Association was 97; and the new members lately admitted have increased the total to 108.

The report presented to the meeting set forth that the demand during the year 1906-7 was very favourable; and it was not possible for the Association to fully meet it. The total deliveries of coke amounted to 239,928 tons, as compared with 200,750 tons in 1905-6; and the average price realized was 16s. 9d. per ton, against 15s. 5d. the preceding year. As the result of a decision arrived at last January, the price of gas coke for 1907-8 was raised 1s. 6d. per ton for the eastern and central parts of Germany, and 2s. per ton for the other districts. By the beginning of February, the constituent works had intimated that 274,000 tons of coke would be available for the current year; and this quantity was speedily sold. Since then very little other coke has been notified for disposal; and unsold stocks are not to be found.

The question of the purchase of coal supplies was also referred to in the report. It appears that the associated gas-works were unable to secure full deliveries of coal last autumn, and also at the beginning of the present year. The deficiency was very considerable in the district of the Saar, where the coal mines are mostly State property; and it ranged from 10 up to 30 per cent. of the tonnage required. As a consequence, it was necessary to purchase a large quantity elsewhere; and the substituted fuel was considerably more expensive. In the circumstances, it is proposed to carefully examine into the present arrangement for buying coal.

The success of the system of uniform sales of coke induced the majority of the constituent undertakings to also entrust to the Association the work of disposing of other products of gas manufacture, more especially tar. As a result, the Association, out of a total production of 70,000 tons of tar, sold about one-half this quantity for 56 works in 1906-7; and in the event of the remainder of the works falling into line, it is hoped to secure suitable prices and ready sales. The Association also disposed of a certain quantity of sulphate of ammonia and other products during the year.

The total value of the turnover of coke and other products amounted to £214,406 in 1906-7, contrasted with £155,000 the preceding financial year; and after paying the owners of the constituent works for their deliveries, and meeting the working expenses, there remains a small surplus, which has been carried forward to the current year.

NEW WATER-WORKS FOR PAIGNTON.

Opening Ceremony.

The formal ceremony of opening the new water-works for Paignton took place on Wednesday last, when the supply was turned on by Mr. F. Layland-Barratt, M.P.

The source of supply is a stream in the Ventford Valley, on Dartmoor, about 5 miles from the town of Ashburton. It is a district with an exceptionally high rainfall, the average for the last seven years being 74 inches; and the watershed is free from human habitations. A storage reservoir has been constructed with a capacity of 200 million gallons. The embankment, which is of granite and concrete, is 616 feet in length; while the greatest depth of the trench was 120 feet, and the excavated length over 800 feet. A roadway carried across the top of the dam is 16 feet in width. In the construction of the dam, about 21,000 yards were excavated; and there have been used 32,000 cubic yards of masonry and concrete. Below the embankment there have been built filter chambers, clean water tank, meter-house, gauge tank for measuring the compensation water, and a caretaker's cottage. The water is drawn off from the reservoir by means of 9-inch and 6-inch valves, fixed in a circular valve-tower, and is conveyed to Paignton through a 9-inch cast-iron main 17 miles in length. A masonry bridge 100 feet in length has been erected at a place where the River Dart has to be crossed; and at Marldon there is a covered service reservoir with a capacity of 600,000 gallons. Arrangements have been entered into by the Paignton Urban District Council for affording supplies of water to the towns of Teignmouth and Brixham and to the village of Ipplepen. Teignmouth is to be entitled to a maximum supply of 250,000 gallons per day, with a minimum of 150,000 gallons, at a cost of 5¾d. per 1000 gallons. The supply to Brixham will be afforded on the basis that the minimum is to be 75,000 gallons per day, and the maximum 200,000 gallons, at the price of 6d. per 1000 gallons; while Ipplepen will have 16,000 gallons per day, at 8d. per 1000 gallons. For the supply of Teignmouth, a 9-inch pipe is being laid, and has yet to be carried under the River Teign; while Brixham will be served through a 7-inch main about 6 miles in length. All the works are nearing completion; but in Paignton itself there have still to be carried out supplementary works for the distribution of the supply, the cost of which is estimated at £12,000. In the Act authorizing the works, which was passed in 1900, power was given to the Paignton Council to borrow £70,000, and such other sums as might be necessary. The additional amount borrowed has been £41,000; so that the cost of the undertaking, exclusive of the distribution works, has been £110,000. Mr. F. W. Vanstone is the Engineer of the scheme, and Mr. Baldwin Latham has acted as Consulting Engineer. Messrs. Hawkings and Best, of Teignmouth, were the Contractors for the storage works; and Mr. Grisenthwaite, of Penrith, laid the main and built the bridge over the Dart.

At the opening ceremony, Mr. Layland-Barratt was presented by Mr. Vanstone with a silver key, with which he unlocked the door leading to the valve chamber and turned on the water into the filter-beds. A large number of gentlemen attended the ceremony, among them being members of the Torquay Town Council and the Paignton, Teignmouth and Brixham District Councils. Mr. Layland-Barratt congratulated Paignton on the approaching completion of the scheme, as well as the other towns which would benefit with it from the advantages of a pure water supply. Though the undertaking had cost more than was contemplated, Paignton would derive great benefit from it, and would no doubt witness a development of building at the higher levels which could not be supplied from the old works. Mr. W. Lambshead, the Chairman of the Water Committee, explained that the cost of the undertaking had been increased by the construction of filter-beds (which were not originally contemplated), by the necessity of raising the dam to supply Teignmouth and Brixham, and owing to the difficulty experienced in finding a solid and water-tight foundation for the dam. These difficulties had been overcome; and he was confident that they had a perfect scheme. Mr. Vanstone expressed the opinion that they had an absolutely water-tight dam. The reservoir was now about three-parts full; the depth at the dam being 47 feet, or about 7 feet from top-water level. The water area was about 26 acres; and it contained about 150 million gallons, which had been impounded in 57 days. This was equal to 100 days' maximum supply for the various towns.

Gas Supply at Stafford.—In the "JOURNAL" for the 11th ult., we gave some figures showing the financial position of the gas undertaking of the Stafford Corporation on the 31st of March last. We now supplement them by a few particulars in regard to the supply of gas. The quantity sent out during the year from the works (which are under the supervision of Mr. Hubert Pooley) was 190,657,000 cubic feet; being a decrease of 995,000 cubic feet as compared with the previous year. The quantity sold to private consumers was 184,350,782 cubic feet; being an increase of 429,929 cubic feet. The gas unaccounted for was 3,923,018 cubic feet; being at the very low rate of 2·06 per cent. of that sent out. The revenue from the sale of gas, less the service to public lamps, amounted to £23,782—a decrease of £147. The sale of residuals resulted as follows: Coke, £4092; tar, £1221; and sulphate of ammonia, £1640—total, £6953, or an increase of £474, due entirely to the improvement in the coke market. Though about 478 tons more coal were carbonized during the year, the cost of coal, &c., was rather less than before.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The year which closed on May 15 has proved to be one of the most prosperous experienced by the Edinburgh and Leith Gas Commission. Were it not for the cloud, in the shape of dearer coal, which is at present hanging over all gas undertakings, it might be hailed as the most auspicious. The Commissioners have reached a turning in the long lane of capital expenditure upon new works, which they have been traversing for some years, and, with the economies they have been able to effect in the manufacture of gas, there was the certainty, had things continued as they were, that the community would have reaped benefits they have not hitherto enjoyed, while the Commissioners would have had the great comfort of working an up-to-date undertaking. But this prospect is, at the present moment, obscured by the advent of higher charges for coal. In the year which the Commissioners have closed, they have sold a greater quantity of gas than they ever did before, in any one year, by 78 million cubic feet. Their next largest sale was in the year ending in May, 1905. Economies in manufacture have been referred to. How great these are will be seen when it is stated that the first section of the Granton works was opened in February, 1903, and that in the year ending in May of that year the output of gas was 1803 million cubic feet, which required 189,295 tons of coal, at a total cost of £116,200; whereas in the year being dealt with, in which all the work has been done at Granton, the quantity of gas sold has been 1931 million cubic feet, produced from 178,524 tons of coal, costing £104,000. We know that carbonizing charges have been very much reduced at Granton. The figures I have given bring out that there is the further great economy of more gas being obtained from the coal. A perusal of the expenditure side of the revenue account reveals that while the Commissioners expended £6875 more than in the year before, £2700 of this sum was due to paying increased salaries and wages, and the rest is quite accounted for by the outlays in connection with the unfortunate brewery well case. The revenue derived from gas was not by any means the largest which has been earned. In the year ending in May, 1902, it amounted to £291,164; and so the past year's revenue of £265,181 represents a saving to the community of £25,983—equal to, roughly, 3d. in the pound upon the rates—accomplished in five years. The great increase in the return from residuals is also notable. In the year 1901-2, the sum realized was £35,720; last year it was £59,190—an increase of £23,470. Increasing revenue and diminishing expenditure have led, in the result, to the largest balance ever carried to the profit and loss account—£102,120—the next largest having been £91,733, in 1904-5. In that year, however, the standing charges were £11,481 less than last year, because the increase of capital had not then begun to tell. In the gas stove account, the most noticeable feature is the absence of profit. The prices for sales and rents for hires are so adjusted as not to bring revenue so much from themselves as to encourage the use of gas. The gas-stove account is made to square—and most probably something more; but the profit in the trade is in the gas which is sold for them. We need not doubt that a considerable proportion of the £11,769 extra derived from the sale of gas was due to the larger consumption in cooking and heating which is now being experienced as the result of the facilities offered. The accounts lie with the Auditor for a month; and it is only after they have been certified by him that the Commissioners can deal with them.

At the meeting of the Commissioners on Monday, the Works Committee reported that they had resolved to acquiesce in the decision in the brewery well case, and had authorized a cheque for the amount of the damages awarded, and interest, to be signed.

It was mentioned some time ago that Messrs. Muir had intimated a claim upon the Gas Commissioners in respect of the alleged pollution of their other well, situated near to the one the claim for which they have successfully vindicated. The second action was called in the Court of Session to-day, before Lord Salvesen. The nature or amount of the claim has not, as yet, been disclosed.

In the Glasgow Town Council on Thursday, Mr. T. Calderwood, the Convener of the Gas Committee, stated that the contract price of the coal they had purchased for the ensuing twelve months was 3s. per ton above what they paid under last year's contracts. This, on a purchase of 700,000 tons, meant an additional charge upon the undertaking of £110,000.

It is intimated to-day that the offer of £9500 which the Town Council of Lanark made to the Lanark Gas Consumers' Company, Limited, as the price of their undertaking, was considered by the shareholders at a meeting on Friday. According to the constitution of the Company, a sale could not take place unless the proposal to do so was carried by a three-fourths majority of the shareholders. A motion to accept the offer of the Town Council was supported by 628 votes, and a countermotion by 352 votes. As there was not the requisite majority, the offer of the Town Council was refused.

The report of the Directors of the Galashiels Gaslight Company, to be submitted to the 23rd annual meeting of shareholders, states that the profit for the past year was £2319, which, added to a reserve of £6785, makes a total of £9104, out ot which it is proposed to pay a dividend of 10 per cent., absorbing £2100, and leaving the reserve at £7004. The quantity of gas manufactured during the year amounted to 70,682,800 cubic feet. The loss by leakage was 3,582,569 cubic feet; and there were used in works and offices 706,800 cubic feet. The quantity which passed through consumers' meters was 66,393,431 cubic feet—an increase upon the previous year of 3,972,809 cubic feet. In consequence of the serious rise in the price ot coal, the Directors have found it necessary to advance the price of gas to 2s. 11d. per 1000 cubic feet; being 2½d. above what it has been for two years.

The Directors of the Kelso Gas Company have declared a dividend of 10 per cent., and, notwithstanding the large increase in the cost of coal, they have resolved not to make any advance in the price of gas.

The Directors of the Kinross and Milnathort Gas Company report that the whole of the capital of the Company, amounting to £3004, has been fully subscribed. There is a disposable balance of £339, out of which it is proposed to pay a dividend of 7½ per cent., which will account for £225; a sum of £64 is to be applied towards depreciation; and £50 is to be added to the reserve fund.

The Auchterarder Gaslight Company have paid a dividend of 6½ per cent. The price of gas for illuminating purposes has been raised from 5s. 10d. to 6s. 0½d. per 1000 cubic feet; for cooking purposes, it is to remain at 4s. 7d. A sum of £50 was voted to the Manager—Mr. A. Lobban—for his good management during the past year.

The report of the Directors of the Kirkcaldy Gas Company states that the make of gas continues to increase in a satisfactory manner; but they regret that, owing to the large advance in the cost of coal, they have been compelled to recommend that the price of gas be raised from 3s. to 3s. 4d. per 1000 cubic feet.

The annual meeting of shareholders of the Stonehouse (Lanarkshire) Gas Company, Limited, was held on Wednesday. It was stated that there had been a great increase in the consumption of gas, owing to the adoption of gas-cookers, of which the Company had issued 69; and many consumers were still anxious to get them. There were 45 new consumers during the year.

CURRENT SALES OF GAS PRODUCTS.

Week ending June 29.

Tar products in the London market have shown little change during the last few weeks. 90 per cent. benzol has become slightly easier, and may be called 9d. per gallon net. 60° crude carbolic is likewise a little lower, at 1s. 7½d. to 1s. 7¾d. net; and in this follows crystals, which are nominally 5¼d. for 35° and 5½d. for 39-40° and are generally rather quiet. Creosote is in very good demand, and nothing under 3d. net would be accepted for this year; indeed, this figure is bid readily for next year. Pitch is firm; and sellers quote 30s. 6d. to 31s. without wishing to sell. Sulphate of ammonia is quietly firm, and, owing to the entire absence of stock, is in a very strong position; and this is accentuated by the continued high price of nitrate of soda.

Sulphate of Ammonia.

LIVERPOOL, *June* 29.

There has been a steady demand throughout the week, more particularly for ready parcels; but it has not been sufficient to establish an advance in prices, makers being anxious to clear out their bins as far as possible by the end of the half year. The closing quotations are consequently £11 15s. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has also been some buying for July delivery at about the level of spot prices; but farther ahead the firmness of makers has hindered business. For July-December, £12 2s. 6d. per ton is quoted; and for January-April, £12 5s. per ton. These prices are quite 2s. 6d. per ton above buyers' present ideas.

Nitrate of Soda.

This article is steady at 11s. per cwt. for 95 per cent., and 11s. 3d. for refined quality.

Tar Products.

LONDON, *June* 29.

The market remains practically unchanged; and creosote continues very firm. In pitch, there is now very little business doing for prompt delivery, though it is reported that a small quantity has been sold on the east coast at 25s., and there are still one or two manufacturers willing to sell at low figures. For forward delivery, the value is unaltered, though, owing to the absence of demand from the Continent, the market does not appear quite so firm as was the case a short while ago. In Liverpool, business has been done at 27s. for a moderately large quantity. On the east coast, however, makers hold out for 30s., and refuse to consider anything under this figure; but dealers cannot at present pay this price. In South Wales, some quantity has been sold for delivery to June, 1908, at 31s. For creosote, London manufacturers now ask 3d.; and it is reported that 2⅞d. has been refused for this quality to the end of the year. In the Midlands, 3d. is still the price asked; and in the North, 2¾d. is the ruling price. Higher figures will very likely be reached before long. Benzol 90 per cent. remains very much depressed, with no alteration in price; but in 50-90's it is reported that some quantity has been offered at 9d., at maker's works. This has been refused, however, and firm offers cannot be obtained from consumers, as there appears to be no demand whatever for this article. Toluol is still very weak, and in no request. In solvent naphtha, the position remains unchanged, and there is not very much business doing. Carbolic acid is still quiet, and consumers do not seem at all anxious to buy. No business is reported in anthracene.

The average values during the week were: Tar, 16s. to 20s. Pitch, London, 26s.; east coast, 25s. to 25s. 6d.; west coast, 24s. Benzol, 90 per cent., 7½d. to 8½d.; 50-90 per cent., 9½d. to 10d. Toluol, 11d. to 1s. Crude naphtha, 4¼d. to 4½d.; solvent naphtha, 1s. 1d. to 1s. 3d.; heavy naphtha, 1s. 2d. to 1s. 3½d. Creosote, London, 2⅞d. to 3d.; North, 2½d. to 2¾d. Heavy oils, 3d. to 3⅛d. Carbolic acid, 60 per cent., 1s. 7½d. to 1s. 8d. Naphthalene, £6 10s. to £12 10s.; salts, 35s. to 42s. 6d. Anthracene, "A" quality, 1½d. to 1¾d.

Sulphate of Ammonia.

There does not appear to be much demand at the present time; and the market is a little easier. The principal London Gas Companies now ask from £12 1s. 3d. to £12 2s. 6d. Ordinary London make, however, can still be bought on Beckton terms at £11 15s., and on f.o.b. London terms at £11 16s. 3d. to £11 17s. 6d. In Leith, the values may be taken as slightly under last week's ruling prices—varying from about £11 18s. 9d. to £12 for prompt delivery, and £12 1s. 3d. to £12 2s. 6d. for forward. In Liverpool, the ruling value may be taken at about £11 17s. 6d. for prompt delivery, and at about £12 to £12 1s. 3d. for forward. In Hull, the price is still £11 15s.

COAL TRADE REPORTS.

Lancashire Coal Trade.

During the last few days, a welcome change has come to our weather; and the effect on the coal market has been to lessen the demand for domestic requirements. Little impression, however, has been felt in other kinds of fuel. There is no alteration to note in quotations. Coal, instead of being cheaper, will be rather influenced the other way if the action of the Railway Companies in increasing carriage rates is carried out. It will be remembered that some time ago the Railway Companies, through the Railway Clearing House, announced their decision to raise their rates for carrying coal, coke, breeze, and patent fuels. Henceforth it is their intention to charge for these commodities at standard imperial avoirdupois weights, instead of reckoning 21 or 20½ cwt. to the ton, or making their customary allowance of 2 cwt. over the actual weight carried per truck. The Railway Companies urge increased cost of raw materials in railway industries and other advancing charges, as well as competition, as the causes of their action. The colliery proprietors naturally object to the threatened impost. A meeting of coal owners was held at the Queen's Hotel, Manchester, on Tuesday, when it was resolved to contest the increased rates of the railway companies.

Northern Coal Trade.

In the coal trade, there has been a lessened production on Tyneside, owing to the chief local holidays of the year, so that the shipments have been a little restricted. In the steam coal trade, the inquiry has been full, and—apart from the cause named—the output is good, with a strong demand. Prices have been steadier. Best Northumbrian steam coals are from 14s. 3d. to 14s. 9d. per ton f.o.b., second-class steams are 14s. to 14s. 3d., and steam smalls are rather scarce at 10s. to 10s. 3d. Gas coals are active, the deliveries having been very heavy this season, and the demand being full both for export and home use. Prices for Durham gas coals for occasional sale vary from about 13s. 3d. to 14s. 10d. per ton f.o.b., though there are still deliveries at much lower figures. Contracts for gas coal are being negotiated both for some of the home companies and for export; and while the prices vary considerably according to the quality, it may be said that there have been sales made from 14s. even to 14s. 6d. per ton f.o.b. for the best kinds, with second-class coals at prices that show corresponding advances on those of the expiring contracts. Other contracts are in the market, but not for large lots. Coke is steady; and gas coke in some cases shows a rise in value—good gas coke being quoted as high as 17s. per ton. f.o.b. on the Tyne.

Scotch Coal Trade.

The market is reported as strong and active; the greatest activity being, as for some time past, in the shipping trade. The Edinburgh and Leith Gas Commissioners are about to purchase the balance of their requirements for the year; and the prices they will be able to get coal at, for forward delivery, will be a good gauge of the probable state of the market in the remaining months of the year. Prices meantime continue to be steady. They are quoted as: Ell 12s. 3d. to 13s. 6d. per ton f.o.b. Glasgow, splint 12s. 3d. to 12s. 6d., and steam 11s. 9d. to 12s. The shipments for the week amounted to 311,602 tons—an increase of 6306 tons upon the previous week, but a decrease of 5706 tons upon the corresponding week of last year. For the year to date, the total shipments have been 6,704,193 tons—an increase of 365,681 tons upon the corresponding period of 1906. Lord Ardwall has to-day issued his award as arbiter in the matter of a further application by the miners of Scotland for an increase of 12½ per cent. to their wages. He heard evidence on the subject in Edinburgh on Monday. In his award, he finds the men entitled to an advance of 6¼ per cent., equal to 3d. per day. This is the fourth advance of a similar amount which the men have received this year. Their wages will now be 6s. 9d. per day.

The Suggested Sliding-Scale for Gas-Coal Contracts.

In a report from the Newcastle Exchange on the subject of gas coal, the "Newcastle Chronicle" says: "At the great gathering of gas engineers, the President, Mr. Charles Hunt, drew attention to the upward tendency of the coal market, as a source of considerable anxiety to the trade they represented. He went on to consider the suggestion that the price of coal should be regulated by Government, as Parliament regulates the price of gas; but he dismissed the idea, though he looked with more favour on the suggestion that 'it ought not to be impossible to arrange a sliding-scale of prices for a term of years that would be equitable to all concerned.' As there is a recognition of the fact that the gradual exhaustion of the most easily-workable seams is causing a permanent increase in the cost of coal-getting, it is possible the suggestion of a sliding-scale might have in it a germ that in the future would do something to limit friction in gas-coal contracts.

Price of Gas at Barry.—When considering an application from the Llandaff and Dinas Powis Rural District Council for a reduction in the price of gas (3s. 9d. per 1000 cubic feet), Mr. S. R. Jones, the Chairman of the Barry Gas and Water Committee, said he thought that the time had come when a reduction could be made. Therefore he suggested that they should reply to the application that the matter would be put before the Council for consideration. This was agreed to.

Local Government Board Inquiry at Leek.—On behalf of the Local Government Board, Mr. W. A. Ducat lately held an inquiry at Leek, with reference to applications to borrow £2255 for works in connection with the proposed supply of gas to the parish of Longsdon and to Rudyard, and £3000 for new meters, fittings, mains and services, and stoves. It was stated that the Ratepayers' Association did not oppose the applications; but they thought the Council were not asking for sufficient money with regard to the extensions to Longsdon and Rudyard. As to the other matter, it was, in their opinion, a good thing to borrow the money rather than pay it out of revenue.

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Encouragement of Artizan Cookery.

The Plymouth Education Authority have published details of the scheme under which they will award prizes for efficiency in artizan cookery which, as announced by Sir Joseph Bellamy at the annual meeting, the Plymouth and Stonehouse Gas Company are offering for competition among the scholars of the local schools. In all, 27 schools in Plymouth will take part in the competition. To the girls attending each cookery centre for public elementary schools, there will be given two school prizes of 5s. each for each school sending three or more classes, and one of 5s. each for each school sending less than three classes. Three prizes of 5s. will also be given to the girls attending the secondary school centre. In addition, there will be centre prizes of 10s. 6d. and 5s. each to he competed for by the girls who obtain the school prizes. The conditions governing the competitions are that the girls are to make a full attendance at the cookery course. The practical artizan cookery of each girl attending the centre is to be assessed in an approved manner during the training course; and at the close there is to be a written examination on the work done. The school prizes will he awarded to the girls obtaining the highest number of marks in this examination. In competing for the centre prizes, the winners of the school prizes will be expected to prepare a dinner in accordance with a menu which will he given to them; and the lady members of the Education Committee will award the prize to the girl whose work reaches the highest standard of excellence. The cooking will, of course, be done by gas. The scheme will cost £13 14s. a year.

Expectations Exceeded at Stockport.—It was announced at the last meeting of the Stockport Gas Committee, by the Chairman (Mr. James Fernley), that the profits on the past year's working of the undertaking have exceeded all expectations. It was estimated that they would amount to £14,000; but the sum actually realized has been £17,400, or £3400 more than was anticipated. It has been decided to allocate £13,000 to the relief of the rates; and it was expected that the balance will he handed forward towards the rates of next year.

Tipton Gas Supply.—The revenue of the Gas Department of the Tipton Urban District Council for the year ending the 31st of March last was £18,674, and the expenditure £12,426; leaving a balance of £6248, compared with £6531 for the preceding year. After meeting interest and sinking fund charges, there was left £1509 to go to the accumulated profits account; bringing it up to £3757. Under the supervision of Mr. S. O. Stephenson, the Council's Gas Engineer and Manager, 10,786 tons of coal were carbonized, and 485 gallons of benzol and 69 gallons of petroleum used; and 125,602,000 feet of gas (coal and water gas) were produced, or at the rate of 11,645 cubic feet per ton. The quantity sent out was 125,502,000 cubic feet, of which 107,841,700 cubic feet were sold and used on the works; heing a decrease of 1·82 per cent. compared with the year 1905-6. The residual products were 7705 tons of coke and breeze, 126,680 gallons of tar, and 262,886 gallons of 10-oz. ammoniacal liquor.

Oldbury Gas Undertaking.

The General Manager of the gas undertaking of the Oldbury Urban District Council (Mr. Adam Cooke) has presented the statement of accounts for the year ended the 31st of March last. The net revenue from the sale of gas to consumers by meter, at prices ranging from 3s. 4d. down to 1s. 6d. per 1000 cubic feet (the last-named figure being for gas used for motive power), and also for public lighting and under contracts, was £14,479; the sale of residuals produced £3628; and the total receipts were £18,345. The manufacture of gas entailed an expenditure of £8850; distribution cost £1307; management, printing, &c., £349; and public lighting and rents, rates, and taxes made up a total of £12,437—leaving a balance of £5908. Dividend on Consols and bankers' interest brought this up to £5972, out of which £2134 was paid as interest, £923 was required for the sinking fund, and £600 was transferred to the general district rate account; leaving a sum of £2315 as the net profit. Adding £6894 brought forward, produced £9209. The working statements show that 9238 tons of coal were carbonized, and 115,253,000 cubic feet of gas made therefrom; the quantity of oil used heing 29,846 gallons, which yielded 11,243,000 cubic feet of gas—bringing up the total to 126,496,000 cubic feet. Of the total make of gas, 101,726,000 cubic feet were sold hy meter, 14,373,000 cubic feet in all were consumed in the public lamps, and 2,901,000 cubic feet used on the works; making a total of 119,000,000 cubic feet, and leaving 7,496,000 cubic feet, or 5·9 per cent., unaccounted for. The residuals produced in the twelve months were: Coke, 5773 tons; breeze, 60 tons; tar, 115,264 gallons; ammoniacal liquor, 213 050 gallons; and sulphocyanide, 33,204 gallons.

Suicides by Gas.—A verdict of "Suicide while of unsound mind," was returned by the Coroner's Jury who inquired into the death, at Finchley Road, of an artist named Elinor Cook, who was found in her hathroom with the taps of a gas-ring and a gas-bracket hoth turned on full. It was stated that deceased had repeatedly threatened to commit suicide. A similar conclusion was come to by the Jury in the case of a Sparkhill jeweller, who fastened a piece of rubber pipe to a turned-on gas-jet, and inserted the other end in a pillow case, which he placed over his head. He had been very depressed, and often complained of pains in his head.

Price of Gas at Ripon.—The Gas Committee reported at last week's meeting of the Ripon City Council that they had had under consideration the question of raising the price of gas. At present the charge is 3s. 4d. per 1000 cubic feet; and there was a feeling that an additional 2d. would tide the gas-works over the increase in the price of coal. It was reported that the deficit on the gas revenue had increased in the last financial year from £3367 to £3699, an increase of £332; and during the current year the advance in the price of coal would involve the works in an extra outlay of £437. The Mayor stated that the Committee had decided to postpone the consideration of the subject till the August meeting; and the action of the Committee was confirmed.

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Increase of Price by the South Suburban Gas Company.

In consequence of the great rise in the cost of coal, the Directors of the South Suburban Gas Company have had to inform the consumers that, instead of reducing the price of gas this year, as they hoped to do, they are compelled to increase it by 2d. per 1000 cubic feet from Midsummer—making it 2s. 7d. per 1000 cubic feet. In a circular-letter signed by the Secretary (Mr. Charles Ohren) notifying the change, the Directors explain that in the spring of last year the rise in the price of coal began, owing largely to the activity of the iron trade; but the great and serious advance did not take place until after the duty on exported coal was repealed on Nov. 1, 1906. The foreign demand then greatly increased, and the price of coal went up in far greater proportion. It is pointed out that the Company work under the sliding-scale, which allows an increase of 3s. 4d. per cent. of dividend for every reduction of 1d. per 1000 feet, and correspondingly reduces the dividend when the price of gas is increased. It amounts to a very considerable sum on the capital of £605,000. This makes shareholders and consumers partners in prosperity and adversity. The principle has also been extended to the employees of the Company, who get a bonus in the form of a percentage on salaries and wages for every penny reduction in the price of gas, and lose it when the price is increased. The bonus at present amounts to 6½ per cent., but the increase of price will reduce it to 5 per cent. Thus all the parties interested—consumers, shareholders, and employees—suffer from the advance in the price of coal. As these form a triple partnership, the Directors say they may rest assured that the price will be reduced as soon as possible.

Plymouth Gas-Works Employees' Annual Outing.

Last week the employees of the Plymouth and Stonehouse Gas Company had their annual outing. As usual, an excellent programme was arranged; but the weather unfortunately proved to be unfavourable. In order that the work might be carried on without interruption, the employees were divided into three parties, the first of which went on Tuesday, and was accompanied by Sir Joseph A. Bellamy, the Chairman, Mr. T. Greek Wills, and Mr. H. D. Bewes, Directors, Mr. H. B. Heath, Secretary, and other officials and visitors. Mr. Percy S. Hoyte, the Engineer and Manager, had general charge of the arrangements. The company, which, with the wives and sweethearts of the men, numbered about 200, drove in waggonettes to Princetown, where luncheon had been prepared. After the luncheon, the toast of "The Chairman and Directors" was heartily drunk; and Sir Joseph Bellamy, in acknowledgment, said that the Directors appreciated to the full the real goodwill which had been shown and the efforts made by the employees in helping to bring about another prosperous year. Referring to the new Workmen's Compensation Act, Sir Joseph remarked that it would not in any way improve the position of the workmen in the service of the Company, who were already in the enjoyment of every possible benefit which could be provided. The Directors had insured all the workmen to the fullest extent—beyond the requirements of the Act, so that in the event of accidents they would receive compensation without regard to any restriction which the Act might contain. Some of the party returned to Plymouth by train from Princetown; but the rest drove to Tavistock, where tea was partaken of. Other parties went through the same programme on Wednesday and Thursday.

Working of Minerals under Water-Works.

The Nottingham Water Committee point out to the City Council that the workings of the Bestwood Coal and Iron Company's colliery have been for some time gradually approaching the Bestwood Water-Works of the Corporation. By the agreement with the Duke of St. Albans, under which the sites of the Bestwood Water-Works and the Red Hill reservoir are held, the minerals under such sites, and for a width of 2 chains round the same, are reserved for the protection of the water-works and reservoir. The Committee have had under consideration the desirability of allowing the coal under such sites to be worked, as they are advised that less risk and danger would arise if the coal were worked continuously in one unbroken line under the sites, rather than that the coal should be left in the form of a pillar for their support. In the latter case, there is a probability that the working of the minerals outside the limits of the coal reserved would do more serious damage to the pumping station and reservoir than if the coal were completely worked out. The Committee are satisfied that the safer course is to allow the minerals to be worked out under the sites; and they think it would be well to enter into an agreement for this purpose on the best terms they can obtain. The Committee mention in their annual report that, after paying the annuities, and interest on loans and consolidated stock, and the annual contributions to the different sinking funds, the balance amounts to the sum of £5718. This they have carried to the account for depreciation, renewals, Derwent water, compensation to workmen under the Workmen's Compensation Act, 1897, and other purposes, making the fund £38,634. On March 31 last there were £75,622 houses supplied. All other supplies numbered 52,941, making a total of 128,563. The estimated population supplied was 340,299.

Railway v. Canal Carriage of Coal to Gas-Works.—It appears that the revenue from the Exeter canal has fallen off during the past quarter, owing to the Gas Company, instead of having their coals by ship through this ancient waterway, preferring overland carriage. This change, as one of the city councillors recently pointed out, is most probably owing to the dues not having been lowered sufficiently for the canal to act as a rival to the railway. The works of the Company are situated close to the canal, and the shipment of coals must have been a great convenience to the consignees. The Navigation Committee are considering the whole question of canal charges, with a view to recovering the support of the Gas Company, who have been for years the best customers of the City Council, as part owners and directors of the canal. The whole subject has a sentimental as well as a business side; for the canal is the first ship canal ever made in England, and the citizens regard with a sort of pathetic regret any diminution of its usefulness or earning powers

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Increases in Price.—The price of gas at Gravesend has been increased from 3s. to 3s. 2d. per 1000 cubic feet to ordinary consumers, and from 2s. 10d. to 3s. to users for power purposes. This course has been necessitated by the advance in the cost of coal. The Truro Gas Company announce an increase of 2d. per 1000 cubic feet.

New Joint-Stock Companies.—The Bedale Gas Company, Limited, has been registered with a capital of £2000, in £5 shares. It is the re-incorporation of the Company under the Companies Acts—it having been originally constituted by memorandum of co-partnership on Nov. 14, 1838. All the shares were taken up and paid for in full prior to the conversion. The Non-Explosive Gas Company, Limited, which has been registered with a capital of £150,000 in £1 shares, will carry on the business of gas and illuminant manufacturers and distributors, &c. The Incandescent Supply Agency (Richmond), Limited, the capital of which is £1000, in £1 shares, will acquire a business in the town named in the title.

Price of Gas for Public Lighting in South London.—The Secretary of the South Metropolitan Gas Company (Mr. Frank Bush) has informed the Borough Councils in the Company's district that, owing to economy in working and the reduced cost of mantles, the Company would, but for the increase they have had to make in the price of gas, have been able to reduce the charge for all public lamps with Nos. two, three, and four burners. With the increased cost of producing gas, however, a reduction in the price paid per lamp is not possible. The economies in maintaining the lamps do not quite balance the extra cost of gas; but, taking all the circumstances into consideration, the Directors have decided not to make any alteration in the price of public lamps fitted with the above-named burners, the rates for which will remain at the present figures—£2 9s. 2d., £2 16s. 9d., and £3 4s. 5d. per lamp.

Water-Rate Payments in Advance at Slough.—A public meeting of ratepayers has been held in Slough to protest against the action of the Water Company in demanding the payment of three months' rate in advance, and to consider what steps should be taken in the matter. The Chairman (Mr. H. W. Pountney) said there were two courses—to appoint a deputation to discuss the question with the Company, or to collect a fund to defend a test case. Eventually the following resolution was put to the meeting and carried unanimously: "That this meeting of ratepayers desires to publicly record in the strongest terms of disapprobation a protest against the action of the Water Company in seeking to recover payment of three months' water-rate in advance, and proposes that a deputation of ratepayers be nominated to meet and discuss the withdrawal of the objectionable condition of payment in advance with the Water Company." The members of the deputation were subsequently chosen.

Llandudno Gas and Water Supply.—At the last monthly meeting of the Llandudno Urban District Council, the reports of the Gas, Water, and Electricity Committee were presented. In moving their adoption, Mr. T. W. Griffith called attention to the report of the Accountant (Mr. W. Wood) upon the undertakings for the year ended March 31 last. There was a profit on the electric light account of £1077, of which £300 had been applied in relief of rates and £664 transferred to the reserve fund, which now amounted to £2013. The profit of the gas undertaking was £1585, of which £500 was carried to the depreciation fund, raising it to £3737. A loss of £827 was shown on the water-works account; but this was considerably less than the loss in the previous year—the amount then being over £1000. The deficiency had been made good by a transfer of £827 from the profits of the gas undertaking. These figures, Mr. Griffiths said, showed that the two strictly trading undertakings of the Council were in a flourishing condition.

Claim by a Lamplighter.—At the Wellington (Somerset) County Court, before his Honour Judge Beresford, Bert Wood sued the Wellington Gas Company for a week's wages, 24s., in lieu of notice. Mr. E. Lee Mitchell represented the defendants. Plaintiff handed to the Judge a letter he received from the Company's Manager on the 16th of May, informing him that, in consequence of a complaint that the lamps were extinguished in his district an hour before time the previous night, his services would no longer be required. He was paid up to the day he left. Mr. Lee Mitchell said Wood was an assistant-stoker at the gas-works, and also a lamplighter for a certain district. It took a man about three-quarters of an hour to go round and light the lamps. On the 16th of May Wood took three hours over it. On his return to the works he did not stay very long. Without saying a word to the chief stoker, he left before ten o'clock to extinguish the lamps. His Honour said he could not alter the law, though he would do so if he could. The law, not common sense, was in plaintiff's favour. He was entitled to a week's notice; and therefore judgment would be given for the amount claimed.

Street Gas Lighting in Battersea.—At the meeting of the Battersea Borough Council last Wednesday, the Lighting Committee reported the receipt of a letter from the Comptroller of the London County Council (Mr. H. E. Haward), suggesting the reconsideration of an application for sanction to a loan of £2270 for lighting by electricity the roads on the Park Town Estate. In the course of his communication, the Comptroller said: "It has been reported to the Finance Committee that 12 out of the 14 streets are unimportant side streets; and, having regard to the heavy cost of installing electric light, and to the fact that little, if any, use would be likely to be made of the mains for private supplies, the Committee do not view with favour the application for the loan. I am directed to inquire further whether the Borough Council have considered the relative cost of lighting the streets with gas and electricity. The Committee are advised that the existing flat-flame gas-burners in these streets could be replaced by incandescent gas-burners and lanterns (thus increasing the light fourfold) at a cost of £2 per post for the 68 posts, or £136 in all. The Committee feel that, in these circumstances, the Council would not be justified in giving its sanction to the loan applied for; but, before recommending that the application be refused, they would be prepared to consider any observations which the Borough Council may wish to make. They trust, however, that the application will be withdrawn." The Council passed a resolution to the effect that they received the communication with regret, but must proceed with their application.

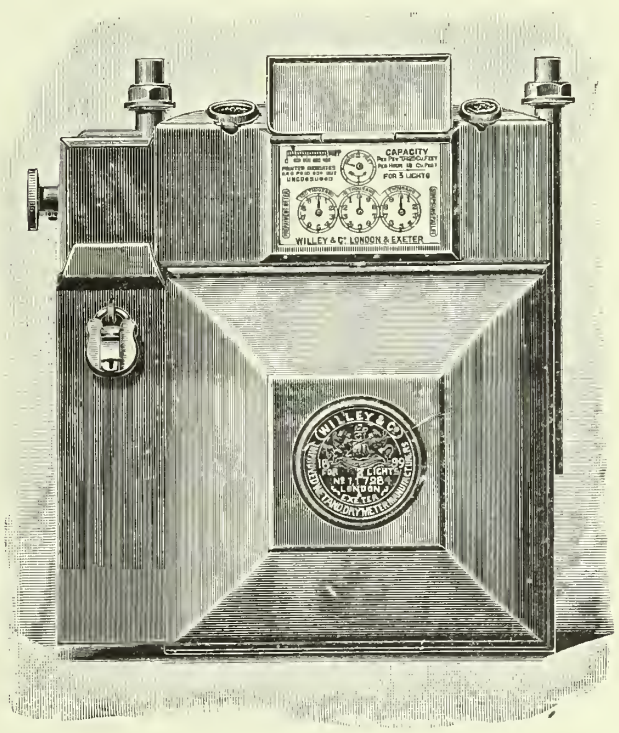
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.



ALL PARTS INTERCHANGEABLE.

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LTD., LONDON & EXETER.

AGENTS FOR SCOTLAND:

D. M. NELSON & CO., 53, WATERLOO STREET, GLASGOW.

The Charge for Water in London.—Though, as will be seen from our "Parliamentary Intelligence," the Metropolitan Water Board (Charges) Bill has passed the Joint Committee of the two Houses, it is not yet safe, for no less than twelve members have given notice that on the report stage of the Bill they will move its recommittal. At the meeting of the London County Council last Tuesday, the Parliamentary Committee were authorized to endeavour to secure an amendment of the Bill so as to provide that annual value shall continue to be the basis of charge for water supply in the extra-London districts.

Sales of Shares.—At the Mart, Tokenhouse Yard, E.C., on Monday last week, Mr. Alfred Richards placed three new issues of capital by order of Directors. Some 4 per cent. perpetual debenture stock of the Southend Water Company fetched £100 10s. to £101 10s. per £100; new £10 ordinary 7 per cent. shares in the Ascot District Gas and Electricity Company, on which 5½ per cent. has been paid, were sold at par; and a parcel of new £10 shares in the Londonderry Gas Company, carrying 7 per cent. dividend, at £12 each. Some consolidated ordinary stock of the Lea Bridge District Gas Company, bearing 6 per cent. dividend, fetched £120 per £100; and similar 10 per cent. stock of the Brentford Gas Company, on which a dividend at the rate of 12½ per cent. per annum has been paid, realized £245 per £100, *cum div.* as from Jan. 1 last. Some original stock of the Faversham Gas Company, on which 7 per cent. has been paid for the last three years, was sold on Wednesday in lots of £10, at from £10 7s. 6d. to £10 17s. 6d. per lot.

Troublesome Electric Lighting at Bristol.—At a recent meeting of the Bristol Sanitary Committee, Alderman Levy asked whether there was any information as to the whole of the electric lamps going out the previous night—the 500-candle power lamps. The Chairman replied that they had no official information. Alderman Levy said this was a very serious matter, and was continually happening. They paid for the full lighting of the streets; but on the previous night the lamps failed from half-past nine for the rest of the night, he supposed. The Chairman remarked that they were out at eleven, but they were on again soon after two o'clock. Alderman Levy added that it was a very strange matter; and he did not think they ought to continually pass it over. The police stated that it was dangerous to the inhabitants with the lights out. The lights were out almost continually. The Chairman replied that they had a full statement a fortnight ago, when Alderman Levy was not present. He thought this showed that on an average one lamp was out for a whole day every year.

Gas-Main for the Bermondsey Sewage-Pumping Station.—At the meeting of the London County Council last Tuesday, the Main Drainage Committee reported that the mains of the South Metropolitan Gas Company in the neighbourhood of the pumping-station now being erected at Shad Thames, Bermondsey, are not of sufficient capacity to enable the Company to supply, for short periods without notice, the large quantity of gas which will be required for the engines at the station. It was necessary, therefore, that a special main should be put down for the purpose; and the Committee were advised that the Company could be compelled to bear the cost. This main, which would be 9 inches in diameter, and was estimated to cost £2175, would be the property of the Council, but would be maintained by the Company. Should the Company at any time desire to make use of the main, they would not do so except on terms agreed with the Council. The Committee recommended that the estimate of expenditure on capital account of £2175, submitted by the Finance Committee in respect of the cost of laying the main, should be approved, and that expenditure on capital account not exceeding the sum named should be sanctioned. The recommendations were adopted.

East Surrey Water Company.—The report of the Directors of the East Surrey Water Company for the year to March 25, which was submitted at the recent meeting, stated that there was an addition of 712 customers during the year; while a further 6½ miles of mains were laid. The additional service storage reservoir works at Alderstead have been completed and put into use, thus very greatly increasing the service storage capacity for the low-service district, which covers the larger portion of the Company's area, and within which the borough of Reigate is situated. Next autumn, it is intended to augment the softening plant at the Purley pumping-station, in consequence of the increasing demand for water. The profit for the year was £27,162, which, with the balance of £2616 brought forward, made a total of £29,778. Out of this, the Board have placed £2000 to the renewal and contingency fund; and recommended dividends for the year, less income-tax, of 5 per cent. upon the preference shares, 7 per cent. upon the ordinary "B" shares, and 10 per cent. upon the original ordinary "A" shares—leaving a balance to carry forward of £3419. The report was adopted; and the Directors were subsequently authorized to raise additional capital. A vote of thanks to the staff was acknowledged by Mr. A. E. Cornewall-Walker (the Engineer, Manager, and Secretary).

The Girvan Gas Company was registered in Edinburgh last week, to take over the business of the Girvan Gas Light Company. The capital is increased from £4000 paid up to £8457. The shares are of £10 each. The public are not asked to subscribe.

The Gas Committee of the Coventry Corporation have considered a letter recently submitted to them from the Coventry Trades and Labour Council, suggesting that a reduction should be made in the charge for gas used through penny-in-the-slot meters; and they have resolved that they are unable to make any change.

As will be seen by an announcement which appears elsewhere, the East Surrey Water Company are about to sell by tender 600 ordinary £10 "B" shares, entitled to a dividend not exceeding 7 per cent. per annum. They are offered in lots of ten; and the last day for the receipt of tenders is Friday, the 26th inst., at 12 noon.

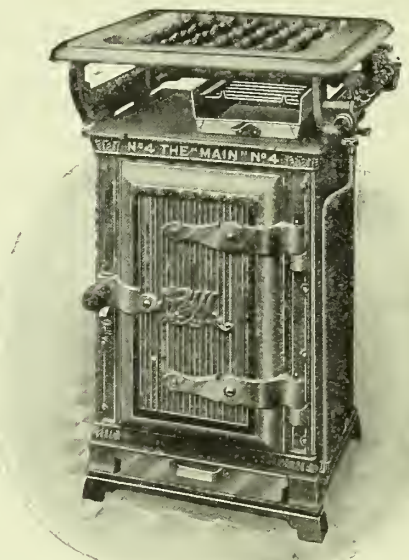
A Local Government Board inquiry has been recently held at Southend-on-Sea with reference to the application of the Town Council for sanction to borrow £1506 for the provision of additional sea-water mains. The extensions consist of 1800 yards of 6-inch and 272 yards of 4-inch pipe, together with stand-pipes for street watering and suitable connections for flushing the sewers.

SEASON 1907.

The "MAIN"

Gas

Cookers



High Grade Cookers.

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R. & A. MAIN, LIMITED,

LONDON, GLASGOW, AND FALKIRK,

ALSO AT

BIRMINGHAM, BRISTOL, MANCHESTER, MELBOURNE, AND SYDNEY

The Richmond Gas Stove and Meter Company, Limited, have obtained the contract for the sole supply of all cookers for use with ordinary and slot meters in the district supplied by the Pontypridd Urban District Council.

When a gas-producer engine was being started at a woollen cloth factory at Trowbridge one day last week, an explosion occurred, severely injuring two men. Both, it is stated, had a narrow escape of their lives, as missiles were hurled in all directions.

Last week, while engaged in starting the suction-gas plant at the Central Wales Granite Works, at Llandrindod Wells, six men were overcome by an escape of gas, and were found in a precarious condition. Three of them were removed to the Cottage Hospital; but later reports stated that all were progressing favourably.

The report of the Directors of Messrs. Head, Wrightson, and Co., shows that the profit for the past financial year amounted to £26,602, to which has to be added a balance brought forward of £6562. After providing for interest on debentures and preference shares, the Directors recommended a dividend on the ordinary shares of 5 per cent., free of income-tax, with a carry-forward of £7114; and this was declared at the meeting last Saturday.

Owing to increasing business, the Edenbridge Gas Company find it necessary to enlarge their works; and ground has been purchased for the erection of a new retort-house. At an extraordinary meeting held for the purpose, it was resolved that the capital of the Company should be increased by the creation of another 2000 shares of £1 each, making the authorized capital £5000.

As the result of a gas explosion in connection with an engine at a Birmingham clothing establishment a few days ago, a porter named Avery was removed to hospital in a very serious condition. The explosion took place in the basement, where a large gas-engine used for generating the electric current for lighting purposes is situated. The engineer had just started the engine, which was apparently in perfect order, when there was a loud report. On going to see what was the matter, he found that the silencer, which receives the exhaust from the engine, had exploded, flinging the brickwork in which it was enclosed in every direction. A hurried examination of the premises revealed Avery lying among the *dèbris*.

The annual report of the Gas Committee of the Salford Corporation, to be presented at the next meeting of the Council, shows that there has been a considerable increase in the number of gas consumers. The sales went up 3·68 per cent. during the year.

The Hailsham Rural District Council have had their attention called to a local well, samples of water taken from which have been sent to the Medical Officer of Health, who has certified the water as being unfit for domestic purposes, as it contains paraffin. It was stated that the tenants had been using the water for some time as fuel. The Chairman remarked that a sample of the water was sent to him; and he had used it for a week to light his fires with. It was somewhat of a yellow colour; but he did not think it was paraffin. The well had been cleaned out on a number of occasions, and tons of water had been drawn; but it continued to be filled by the same liquid. There were two other wells near by; but these each contained pure water. The Inspector said that when the lid was removed from the well, a strong smell of paraffin came up.

At a meeting of the members of the City of Birmingham and District Coal Merchants' Association, held at the Birmingham Exchange last Thursday, it was unanimously resolved—"That in the opinion of this Association the proposed increase of rates for the carriage of coal, coke, breeze, and patent fuel issued from the Railway Clearing-House on June 12, is unjust in principle and the time of its issue inopportune, and that, therefore, it should be strenuously opposed." The proposal of the railways here referred to is to base their charges on the net ton of 20 cwt. Since 1895, the general rule (with varying exceptions for different parts of the country) has been for coal to be carried at 20½ cwt. to the ton. No proportionate decrease is to be made in the money charge, and the loss of ½ cwt. will be equivalent to an addition of 2¼d. on every ton of coal carried. Coal traders are unanimously opposed to the alteration. The petition which the London Coal Merchants' Society are lodging with the Board of Trade will be presented in a few days. Apart from the point of the inadequacy of the notice given, which is considered a strong one, seeing that the traders' long contracts have only just been entered into, the alteration will be mainly opposed on the ground that it is equivalent to an increase of 2½ per cent. in the charges, and that it abolishes the custom of an allowance for the waste inseparable during transit and from shunting operations, &c.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.
CLERK (BRAZIL). Ceara Gas Company, London.
ASSISTANT MANAGER. Borough of Barrow-in-Furness. July 17, 1907.

Situations Wanted.
ASSISTANT TO ENGINEER. No. 4793.
SULPHATE OF AMMONIA LEAD WORK. No. 4791.

Plant (Second-Hand), &c., for Sale.
ENGINE AND EXHAUSTER, &c. Riddings Gas Company.
GAS-ENGINE, &c. "G. S.," c/o West End Advertising Agency.
STATION METER, ENGINE AND EXHAUSTER, PURIFIERS, SCRUBBERS, WASHERS, ENGINES AND BOILERS, AND OTHER GAS WORKS PLANT. Hastings Gas Company.

Stocks and Shares.
EAST SURREY WATER COMPANY. July 26.
UXBRIDGE GAS COMPANY. July 17.

Company Meeting.
EUROPEAN GAS COMPANY. Offices. July 16. 2.30 o'clock.

TENDERS FOR

Coal and Cannel.
BARNOLDSWICK GAS DEPARTMENT. Tenders by July 6.
EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by July 8.

Coal and Cannel.—*Continued.*
LINCOLN GAS DEPARTMENT. Tenders by July 15.
OLDBURY GAS DEPARTMENT. Tenders by July 13.
OMAGH GAS DEPARTMENT. Tenders by July 30.

Concrete (Reinforced) Floors.
COVENTRY GAS DEPARTMENT. Tenders by July 10.

Tar and Liquor.
ALTRINCHAM GAS COMPANY. Tenders by July 9.
ATHERTON GAS DEPARTMENT. Tenders by July 9.
COVENTRY GAS DEPARTMENT. Tenders by July 10.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 16.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
100,000	5	May 15	7	Bombay, Ltd..	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Feb. 28	14	Bournemouth Gas and Water 10 p.c.	27½—28½	..	4 18 3
51,810	10	,,	7	Do. B 7 p.c.	16½—17	..	4 2 4
53,200	10	,,	6	Do. Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	,,	12½	Brentford Consolidated	247—252	+2	4 19 2
300,000	,,	,,	9½	Do. New	188—193	..	4 18 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	117—122	..	4 2 0
206,250	,,	June 13	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41—43	..	4 13 0
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c.	119—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c.	90—93	..	4 16 9
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	11—11½	..	6 1 9
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95*	..	4 4 3
150,000	20	Mch. 14	8¼	Cagliari, Ltd.	25—27	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref..	8½—9½	..	4 14 9
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96*	..	4 13 9
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord.	109—111	..	4 10 1
1,443,280	Stk.	,,	5 2/10	Commercial 4 p.c Stk.	105—108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	102—105	..	4 15 3
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk.	103—105	..	3 16 2
486,090	10	Jan. 31	12†	European, Ltd.	23—24	..	5 0 0
354,060	10	,,	12†	Do. £7 10s. paid	17½—18½	..	4 17 4
15,203,110	Stk.	Feb. 14	4 4/10	Gaslight and Coke 4 p.c. Ord.	93—95	+1½	4 12 7
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	88—90	+1	3 17 9
3,799,735	,,	,,	4	Do. 4 p.c. Con. Pref.	102—105	..	3 16 2
4,193,975	,,	June 13	3	Do. 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	170—173	+1	4 12 6
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110*	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A	221—223	−1	4 9 8
718,100	,,	,,	7	Do. B	163½—164½	..	4 5 1
144,140	Stk.	Feb. 14	7⅝	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4—4½*	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb..	100—102	..	4 18 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Feb. 28	4⅝	Newc'tle & G'tesh'd Con.	106—108	+1	4 5 8
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	94—95*	..	3 13 8
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	143—148	..	5 8 1
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord.	6¾—7¼	..	4 16 7
796,980	5	Jan. 31	5	Do. 5 p.c. Pref.	5—5¼	+⅛	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
1,000,000	10	Apl. 26	8	River Plate Ord.	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95*	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	12½—13	..	6 3 1
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Mch. 14	10	Sheffield A	245—247	..	4 1 0
209,984	,,	,,	10	Do. B	245—247	..	4 1 0
523,500	,,	,,	10	Do. C	245—247	..	4 1 0
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,350,000	Stk.	Feb. 14	5½	South Met., 4 p.c. Ord.	117—120	−1	4 11 8
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	83—85	..	3 10 7
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	157—159	..	5 0 8
605,000	Stk.	Feb. 28	5½	S'th Suburb'n Ord. 5 p.c.	117—121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 10 11
117,058	,,	Jan. 16	5	Do. 5 p.c. Deb. Stk.	125—130	..	3 16 11
502,310	Stk.	May 15	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Feb. 28	6½	Tottenham and Edmonton A 5 p.c.	123—126	..	5 3 2
398,940	,,	,,	5	Do. B 3½ p.c.	100—103	−½	4 17 1
137,500	,,	June 27	4	Do. 4 p.c. Deb.	99—101*	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	102—104	..	4 16 2
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	106—108	..	4 12 7
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c.	—	..	—
255,636	,,	,,	6½	Do. B 3½ p.c.	131—136	−2	4 15 7
75,000	,,	,,	5⅗	Do. C 3½ p.c.	—	..	—
79,416	,,	June 27	3	Do. 3 p.c. Deb. Stk.	77—80*	..	3 15 0
845,872	,,	Feb. 28	5⅛	West Ham 5 p.c. Ord.	102—105	..	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103*	..	3 17 8

Prices marked * are "Ex div," † Next dividend will be at this rate.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
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This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

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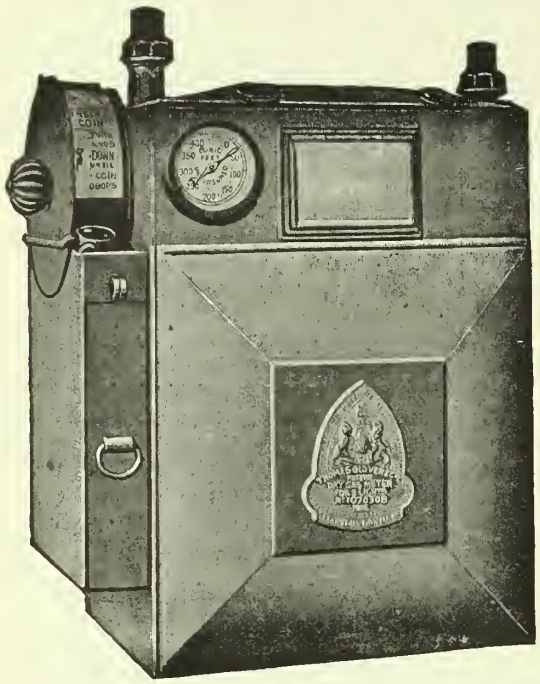

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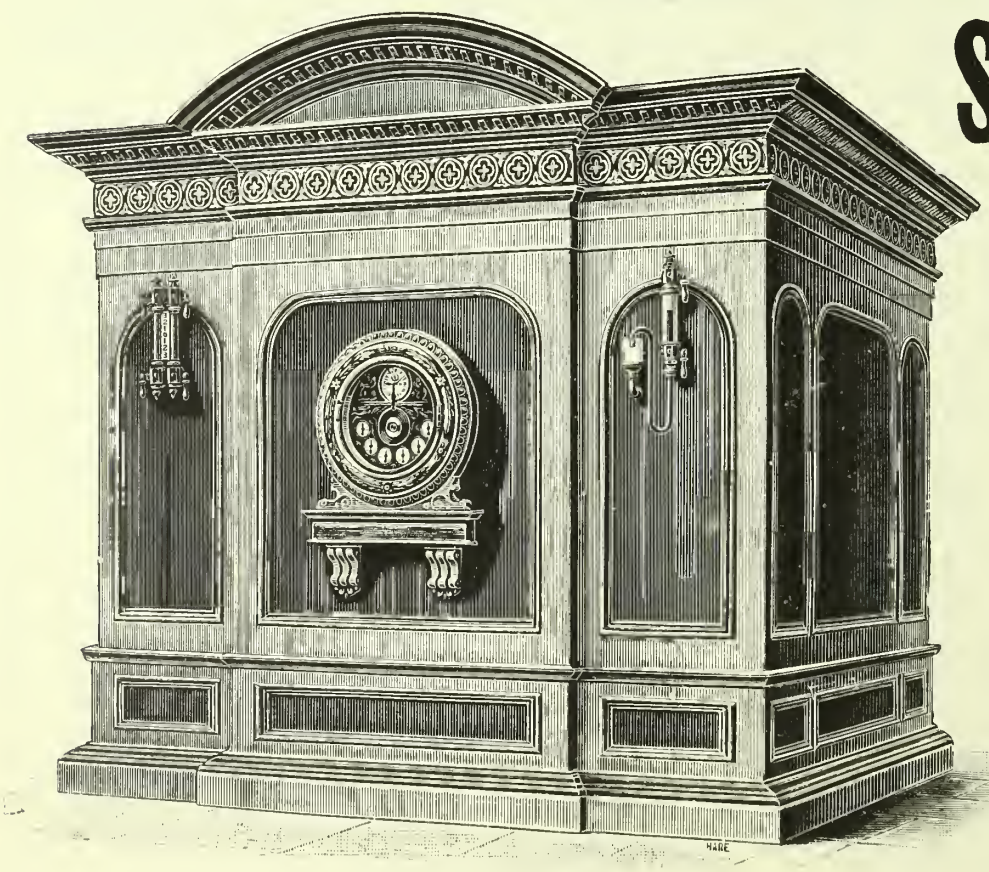

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. XCIX., No. 2304.——TUESDAY, JULY 9, 1907.

EDITORIAL NOTES—GAS, &c.

Rejected!

THE House of Lords have righted the wrong which the Police and Sanitary Committee of the House of Commons committed in the matter of the proposed expropriation of the East Hull Gas Company's property by the Corporation; and the manner in which the Earl of Donoughmore's Committee did the just thing lends piquancy to their decision. They gave a rebuff which, by its sharpness on the case alone of the Corporation for compulsory sale, was eloquent of their appreciation of the inherent weaknesses of that case, and of the dearth of justification that it presented. Furthermore, their Lordships were true to the traditional practice of their House, to defend statutorily controlled private enterprise against marauding municipalizers, without there being a clear case of wilful default or transparent proof of public advantage. Neither the one nor the other could be shown in this instance. Indeed, the Corporation case had a miserable foundation for the heavy superstructure reared by their professional witnesses, the members of which superstructure were drawn principally from the Board of Trade returns and from the experience of what others had done under different circumstances through the acquisition mostly by agreement or by the transfer of non-statutory undertakings in days different from the present, and when gas was a monopoly of a complexion totally distinct from what it is to-day. The ancient and the modern are in disagreement, and the disagreement is the outcome of present-day municipal policy, which seeks to bring under one dominion all public enterprises, competing or otherwise; and that is a policy that is not, we maintain with deliberation, in the best interests of the public.

It is a reflection upon the acumen of the Police and Sanitary Committee of the House of Commons, or else a corroboration of our previously expressed opinion that with the Committee "any excuse was better than none" for setting aside justice and giving support to a case for municipalization, that the Earl of Donoughmore's Committee did not require to hear the Company's evidence, which Mr. Corrie Grant's Committee said, if they did not think, was so essential; and this confirms Mr. Balfour Browne's view, when before the Committee of the other House, that there was no case to answer, and therefore no necessity for calling any expert evidence. Professedly, the Commons Committee accounted it (for it suited their purpose) an act of pusillanimity on the part of Mr. Balfour Browne in not tendering evidence to rebut the alleged petty acts of misdemeanour on the part of the Company; the House of Lords were satisfied, without hearing the evidence proffered by the Company on this occasion—and proffered only to avoid false assumption—with the opulent testimony to a hollow and laboured case that Counsel and witnesses for the Corporation submitted, with naturally the best of intention to do something to justify the confidence of the Corporation in them. That they failed is not their fault; they cannot make sound bricks any more than anyone else can without the proper means.

Most of the witnesses, manifestly feeling the weakness of their case, tried the effect of impressing the Committee with the view that the proprietors of the gas undertaking would not suffer, as the Corporation—magnanimity incarnate—were perfectly willing to pay them a "fair" price. The notions of the Corporation as to what is right and fair in the matter of recompense under the circumstances have been brought rather boldly and forcibly within the range of vision by their repeated endeavours to knock on the head, in this instance, the percentage allowance awarded in compulsory sales in the case of arbitrations under the Lands Clauses Acts. The Lords Committee also had dangled before them the fact that the average capital expenditure, per million cubic feet of gas sold, of gas undertakings in the possession of local authorities is lower than that of the average of gas companies. But the difference was minimized by a statement that this was partly accountable to stock conversion. There can be no use in presenting such figures, unless the intention is that a Committee should draw the inference that local authorities are more provident than companies in the matter of capital expenditure. Is it fair to make use of these figures without an explanation of all the other circumstances that go to swell the average capital expenditure of gas companies in comparison with local authorities? We say that it is not. It is suggested by Mr. Charles Hunt that, as local authorities have usually had to pay large sums for goodwill, the comparison holds good—that is to say, the amount paid for goodwill is a fair set-off to the inflation of the companies' average produced by the conversion of capital. To prove its correctness, we want something more than the bare iteration of this in Parliamentary Committee-rooms and elsewhere. The transfers of the large gas undertakings to local authorities were made many years ago, before the businesses were of anything like the magnitude they are now; and the amount paid for goodwill was insignificant compared with what it would be to-day. Assuming the statement to be correct, do goodwill and conversion embrace all the considerations that make comparison fair? These are matters that are not beside the main question, seeing that they were used as make-weight in the case of the Hull Corporation. There was one other point, too. Was it a slip of the tongue, or an intentional act, that the Hon. J. D. Fitzgerald should have described to the Committee the "suspensory" clause inserted in the Company's Act of 1906 as a "purchase" clause? The description might have all the difference in its influence. However, the two suspensory clauses in Gas Bills of 1906 have been for some people a snare and a delusion, and that has been the sum-total of their effect.

The details of the evidence laid by the Corporation before the Lords Committee were much the same as those upon which we commented when the Bill was before the Police and Sanitary Committee of the Commons. It was not strengthened in any way; and therefore we will not waste time and space in further criticism. But we will merely say, in conclusion, that the victory of the East Hull Gas Company has been complete; and the Board of the Company and their advisers in this matter merit the warmest thanks of all engaged in statutorily-controlled private gas enterprise in the kingdom. The Company's legal representatives throughout were Mr. Balfour Browne, K.C., Mr. Honoratus Lloyd, K.C., and Mr. A. M. Paddon; and the expert advisers were Messrs. Corbet Woodall and Son and Messrs. W. A. Valon and Son, with the Company's own energetic Engineer, Mr. J. Holliday. Their firmness and tenacity, supported by a united Board of Directors, has had a result of far-reaching importance to statutory gas companies; and we congratulate them. Of this we are quite sure, that not only have they by their work given a new lease of life to the East Hull Gas Company, but they have put a spoke into the municipalistic wheel, the revolutions of which, under the propelling force of present-day socialistic agencies, bode no good for the future of this country. Anyway, for Hull we should imagine that the question of further gas-works purchase is dead for some years, unless the Corporation can summon up courage sufficient to follow the opinion of Alderman Larard that the whole gas supply of Hull should be under municipal control, and promote a Bill to acquire the British Gaslight Company as well as the East Hull Company. The order is a big one; and we think the Corporation, before they venture to deal with it—if ever they consider the attempt worth the making—will desire to live down the memory of the impression they made this session in the House of Lords, that no public purpose would be served by the transfer to them of the East Hull Gas Company. The petty charges they preferred against the Company of peccancy in financial conduct were eclipsed by the

trenchant examination into their own financial doings and indifferent success in connection with certain of their trading departments; and they have yet to clean their own slate, to reverse the order of things existing in Hull—viz., that the cheapest gas is furnished by Companies, and not by the Corporation—to produce proof that they can do better than the Companies, and to show that the latter have really abused their privileges, before anyway the House of Lords (the present municipal-ridden House of Commons can well be left out of the question) will consent to violate the security and protection they have themselves created and dispensed.

The Defensive Power of Low-Priced Gas.

There are many people who tell us that the price of gas is, generally speaking, at a sufficiently low level, with the incandescent system at command, for illuminating purposes. While admitting the truth of this, we are reminded by others that a considerable percentage of gas is used for cooking, heating, and power purposes, and that a price for gas that is low for illuminating use may be high for these branches of business, and therefore not conducive to their greatest development. This being so, unless a reasonable all-round price can be attained to compass the requirements of all classes of business, we are brought face to face with the necessity for differential prices, if business is not to be allowed to stagnate, and competitors be given entry at an unguarded door. The gospel of prudent low prices has always been preached in these columns; and their potency in these times, in retarding the progress of competitors, has received some notable illustrations. Private and street electric lighting have, in the places in mind, moved forward sluggishly, and suction gas plant has not made headway, with its inherent frailties and inconsistencies and deficiencies in brake horse power in comparison with town's gas.

Those readers who perused the short report in our "Miscellaneous News" last week, headed "Gas and Electricity at Sheffield," will have remarked that the low-priced gas in that city is viewed with joyless interest by the Corporation Electricity Department. Every gas-supplying company or authority cannot expect to reach the heights on the pinnacle of low prices attained by Widnes, Sheffield, Plymouth, and certain other places; and unfortunately high coal prices have come upon the industry to hinder those whose policy is the lowest possible price with good returns from the maintained and extended volume of business. But what was said at Sheffield, during the meeting there of the Incorporated Municipal Electrical Association, by the Lord Mayor (Alderman R. Styring), Sir William Clegg, and others will serve as a stimulus in the gas industry, by the illustration given of the value of low prices in meeting the competition of electricity. The Lord Mayor is not of those who regard the act of the Gas Company in standing in the way of the progress of the municipal electricity supply as almost Machiavelian in character, and who would doubtless like to see the Company's undertaking transferred to the Corporation—not for the purpose of benefiting the citizens, but with the object of so administering the concern that its impregnable position in relation to electricity should be broken down. The citizens would find something amiss with the philosophy of such advocates if the suggestion were ever seriously submitted in the Council Chamber. A greater acknowledgment of the strength of the Gas Company could not have been made, nor a greater compliment paid to the sagacious management of Directors and officials, than what has been described as the pathetic confession of the Lord Mayor that the Corporation electricity undertaking is singularly handicapped, and is carried on under most trying conditions—"singular handicapping" and "trying conditions" being concentrated in low gas prices. If the members of the Association did not realize it before, they did by the time his Lordship finished his remarks on the subject, that the low price of gas is "a factor of the greatest importance "to the Corporation in carrying on their electricity under-"taking," and that it subjects those engaged in conducting the latter to "a severe strain."

However, his Lordship protested that he did not complain of the cheapness of gas, as the citizens reaped the benefit. But the subject took such a firm hold during the meeting, that it turned up again at the dinner, when Sir William Clegg observed that "some of them would have to seriously "consider what was the wisest course to follow in regard to "the Gas Company in the future. . . . It might be "desirable to open negotiations with them with the object "of purchasing the concern." The idea is a droll one, and worthy an after-dinner speech. If earnestly made—and Sir William has since assured the readers of the local papers that it was—the citizens would consider well the purpose and consequence of such a proceeding before they gave their sanction to it. The only interests such a transfer of management could possibly serve would be those of the Electricity Department. The two undertakings coming under one management, competition would practically cease, gas and electricity prices to consumers could be ordered as the municipal monopolists willed, and the price of gas could be put to such a figure to the detriment of the consumers that it would no longer possess the power that it has in the present of forming a barrier past which increments of electrical business can only slowly trickle. Under municipal management, the private and manufacturing consumers would lose the safeguard that they have in the maintenance of competitive management and enterprise. Cheap gas has a strong place in their affections; and it is private enterprise that has given it to them. With that private enterprise they are very well content; and Sir William Clegg must look elsewhere than to municipal ownership of the gas undertaking for a solution of the difficulties under which the municipal electricity undertaking in Sheffield laboriously moves. Moreover, Sir William is sage enough to see that there would be no use going to Parliament with a "public "policy" case for compulsory purchase; and so any transfer would have to be with the Gas Company as willing sellers. The day when they will be that is certainly not yet.

A Curious Judicial Award.

Never before, we believe, can so unique a point have been submitted to a legal tribunal as that which was recently placed before an Arbitration Court at Rome in a dispute between the Municipality of Messina, in Sicily, and the Continental Union Gas Company, Limited. The town authorities sought to profit by a clause in the contract with the Gas Company which (though we have not the actual wording of it before us) in effect seems to have specified that, should scientific progress lead to economies in the manufacture of coal gas, the public and private consumers of Messina should benefit thereby. Bearing in mind the date of the agreement between the two parties (the year 1861), and also the state of Italy at that time—still unconsolidated and backward in trade and development—such a clause hardly appears unreasonable when handing over to a foreign and monopolistic Company the public and private illumination of an important port and town. Forty-five years later, when the Messina Municipality owed the Gas Company a sum of about £25,000 for the public lighting, the Town lodged a claim for a share in various profits and economies alleged to have been made in gas manufacture. The claim was submitted to arbitration, and the decision is set out in the June issue of our Italian contemporary "Il Gaz;" a summarized translation of the award being given in our "Legal Intelligence." The *Collegio Arbitrale*, or Arbitration Court, declares that there are three processes of gas manufacture which constitute scientific progress from (we suppose) what was in vogue in the Messina Gas-Works in the year 1861. These three are, firstly (and surprisingly), mechanical exhausters; secondly, "the new process of puri-"fication" (whatever that may mean); and, thirdly, "pro-"ducers built for the carbonization of coal," by which we understand must be meant regenerative furnaces.

As regards the first point, we are convinced that gas exhausters must have been in use, even in Messina, in 1861; for, apart from pump exhausters, Beale's rotary exhauster dates from 1848. The new purification process we can only suppose is some form of rotary washer-scrubber. But, not content with determining these "scientific" improvements, the Court proceeds to allocate to each the economy it has produced. The lion's share is given to the exhauster, which accounts for 0·96 c. per cubic metre of gas, or approximately 2½d. per 1000 cubic feet. The purification process is valued at 0·19 c. per cubic metre, or less than ½d. per 1000 cubic feet; while the regenerative furnace has economized 0·85 c. per cubic metre, or some 2¼d. per 1000 cubic feet. It would certainly be interesting to have detailed figures of these results of such new and economical processes. Were these prices, however arrived at, to be multiplied by all the cubic metres of gas made since the introduction of the so-called novelties, the result might be serious to the Continental Union Gas Company. But the Arbitration Court condemns the

Company to pay only on the gas made since Jan. 29, 1906—the date of the arbitration proceedings; so that the damage apparently only amounts to a matter of about £500. It seems, however, to carry with it a definite reduction of 1 c. per cubic metre in the price of gas both for public and private lighting. As, however, the Company have only to pay one-third of the costs of the actual arbitration proceedings, and as other demands of the Municipality have been rejected, the total result appears to be in favour of the Company and against the Municipality. The persons who profit mostly, it seems, are the three Arbitrators, who are to divide equally the sum of £720; and we suppose the Municipality of Messina are still left with a larger load of liability to pay off. Altogether, a somewhat curious arbitration.

Testing Electricity.

Why all this bother? The Metropolitan Borough Councils who supply electricity are surely needlessly alarming themselves over a simple proposition of the London County Council—at least we will do them the credit for the moment of thinking so, though we must, of course, admit that they know best. The County Council are proposing to establish a number of stations for testing the pressure at which electrical current is being supplied to consumers. The Law and Parliamentary Committee of the Fulham Borough Council avow that the cost of providing these testing-stations would be something enormous; and Bermondsey, Battersea, Hackney, and may be several other Councils, are also protesting against what they term the needless expenditure for this purpose. In a measure, we sympathize with the electrical distributors; but we do want to know why they should be allowed to go scot-free while gas suppliers have had for many a long year to wear the bridle manufactured by the joint exertions of Parliament, the Spring Gardens Authority, and the Metropolitan Gas Referees. Our electrical friends are perhaps not sufficiently instructed in Metropolitan Gas Affairs to know that there are no less than 22 stations in London at which gas is, by the most refined means available, tested for illuminating power (by both the standard and a flat-flame burner), for purity, and for calorific power; and the gas examiners have authority to indulge in peripatetic exercise in making examinations for pressure at public street-lamps. Save for calorific power and illuminating power by the flat-flame burners, penalties attach to lapses under prescribed conditions. We have strong views as to the uselessness of all this testing in these days when competition protects the public, and any backsliding brings, through the production of discontent, its own injury upon the supplier. But, at the same time, we are not favourably disposed to inequality of laws, and therefore fail to see why gas suppliers should be so watched and pryed upon under the delusion that it is necessary in the interests of the public, while electricity suppliers have fully uncontrolled liberty. It is well known that voltages have an unhappy way of varying considerably, and that consequently the consumers suffer. Unquestionably that is why, and not the expense of the testing-stations, the proposal of the County Council is regarded with such displeasure. The expense is a lame excuse. As to cost, the three London Gas Companies have had to bear the expense of the twenty-two stations at which gas testing is performed; so that the electricity suppliers have not much at which to grumble. When the President of the Board of Trade remembers what is done in the matter of testing in the case of gas supply, he is likely to treat lightly the protest of the electricity suppliers, and especially the ground upon which the protest is made.

Unaccounted-for Gas and Consumers' Meters.

The communication on this subject by Mr. Norton H. Humphrys, which appears in another column, amounts to a strong indictment of the Sales of Gas Act. The author considers that its connection with the item of unaccounted-for gas has not been sufficiently regarded, and addresses himself to the task of showing that, in practice, there is a great difference—and that to the disadvantage of the seller—between a meter that registers a fixed percentage slow, and one that passes even a small percentage unregistered. The loss from the last-named cause is the more unsatisfactory because it is uncertain and indefinite. He shows that the small percentage of unregistered gas may, in practice, amount to as much as 33 per cent. of the total quantity registered; and he suggests that any future amendment of the Sales of Gas Act should include stringent regulations in respect to unregistered gas, and also that since the meter has an inherent tendency to tell against the seller, there is no reason why the buyer should receive the advantage of the turn of the scale.

Electric Street-Lamp Returns.

In the report of the Council of the Incorporated Municipal Electrical Association, we read that, in order to provide data to "controvert the statement so often brought forward by those interested in the supply of gas for public lighting," to the effect that electric lamps are not suitable for street lighting, the Council have issued a schedule of questions to every "municipal electrical engineer" with a view to publishing periodically a progress sheet showing the number of gas-lamps displaced by electric lamps. The returns are not yet complete; and the final result of the Council's action is to be subsequently published in the Association's "Proceedings." We may be excused for wondering how returns as to the number of street electric lamps in places supplied with electricity by municipalities will "controvert" the statement that electric lamps are not the most suitable for street lighting. What the returns will demonstrate is the interest in street electric lighting of local authorities who are under an obligation to produce as good a balance-sheet as possible for an electricity undertaking—no matter out of whose pocket the revenue is derived. It would be a matter for regret if the Council were to take amiss two or three suggestions which we submit, in order to make the returns as perfect as possible. It would be instructive if the returns were made retrospective, so as to show the progress (say) during the last two quinquennial periods. It would also be interesting if the returns included towns where the electricity supply is not under the management of the local authorities. It is hoped, too, that the returns will discriminate between flame and ordinary arc lighting, Nernst, Tantalum, other metallic filament lamps, and carbon filament lamps. Also that the prices paid per lamp—including all expenditure—will be given, as well as the mileage of road lighted, with the comparative figures for incandescent gas lighting. Such returns should have a comprehensive usefulness. We further trust that it may be within the region of practicability not only to enter the returns in the Association's "Proceedings," but to give the returns the greatest possible publicity, so as to enhance their value. Anyway, if a copy is addressed to the "Journal" office, it will be gratefully received. Always willing to give reasonable help in good work, the Council will no doubt like to make a brief announcement in the returns to this effect: In the year when the first Electric Lighting Act was passed (1882), the number of public lamps supplied by statutory gas undertakings in the United Kingdom was 361,311; in 1905-6 (the year covered by the last Board of Trade returns), the number of public lamps supplied by statutory gas undertakings was 665,791.

In Support of Private Enterprise.

Considering all the circumstances of the case, it was no more than natural that there should have been, at the annual meeting of the Industrial Freedom League last week, a good deal of satisfaction expressed with regard to the results of the recent County Council elections in the Metropolis. For the gratifying change that then occurred in the constitution of the Council, the speakers at the meeting claimed some credit as being due to the League; and there does not seem any real justification for questioning the accuracy of this contention. For some years past the League have incessantly occupied themselves in placing before the public their very pronounced views on the subject of municipal incursions into the realms of speculative trading; and though there has no doubt been a certain amount of reiteration of their arguments, it must be urged in excuse—if, indeed, any excuse be needed—that a great deal of repetition is generally necessary before any substantial impression can be made upon the public mind. It may well be that in the opinion of some people the League have gone to the other extreme in their arguments against municipal trading. But these are days of extremes; and the answer to any such criticism would no doubt be that it was necessary to point to every conceivable eventuality in order to fully rouse the popular mind to a sense of the danger which lies ahead. Be this as it may, however, there is clearly one thing that must be at once admitted by everyone—and this is that both the present President of the League,

Sir Felix Schuster, Bart., and his predecessor, Lord Avebury, are men whose intimate knowledge of money matters is such as to entitle their opinions, at any rate on the financial aspect of the question, to the greatest possible respect. In our "Miscellaneous News" columns to-day, there will be found an account of that portion of the proceedings which related more particularly to branches of the subject in which readers of the "JOURNAL" are specially interested; and from this it will be seen that gas, water, and electricity all came in for some share of attention. The Metropolitan Water Board was cited as a case in which there has been a distinct—and unwelcome—difference between "expectation" and "realization;" it being pointed out that, so far from the public having gained in the shape of "profits," there is a scheme on foot to raise the charges for water, while at the same time they have lost the safeguard which they formerly possessed in the vigilant watching of the Water Companies by the Local Authority. As regards gas, the recently mooted acquisition of the Sheffield undertaking by the Corporation was criticized; and it was prophesied that in the event of purchase, the consumers would have to face considerably higher prices for gas, before there were any profits realized for allocation to the relief of the rates. It was further pointed out that the electricity consumers would likewise suffer by having to pay more for their current in consequence of the withdrawal of the severe competition of cheap gas to which the municipally owned electrical undertaking is now subjected. As to London, Lord Avebury gave it as his opinion that the throwing out of the Electricity Bill of the present County Council meant that people would have to pay higher rates than they need for an electricity supply, because the present House of Commons would not, if they could help it, allow anything to be done by private enterprise.

Corporation Gas Undertakings.

A further batch of results of the past year's working of Corporation gas undertakings is noticed to-day; and from the points that are to be gathered from them, the few following may be mentioned. At Coventry, a very gratifying increase in the quantity of gas sold has been experienced—51 million cubic feet, or 7·23 per cent., over the previous year—and for this, of course, thanks are due to the industrial prosperity of the city. The average price of gas is now lower than it has ever been since the Corporation acquired the undertaking—namely, 2s. 2·21d. per 1000 cubic feet. The price of gas for manufacturing purposes is 1s. 9d.; and it is stated that by this reduction all the large consumers have been retained, and no one is to-day thinking of putting down a gas-producer plant. The district fund is to receive £2000. The sale of gas at Darlington has gone up from about 311 million cubic feet to 325 millions, and the gross profit from £11,851 to £13,480. The sum of £4000 has been transferred to the district fund in aid of the rates. The annual report at Hereford is the first one presented by the new Engineer, Mr. W. W. Townsend, whose efforts are much appreciated by the Gas Committee. Though there was an increase in the consumption of gas, the gross profit is about £350 less than was the case in the preceding year, owing to a reduction in price having extended over the full period instead of only nine months. With a bigger sale by 123,000 cubic feet, the quantity of coal carbonized was reduced 300 tons; in other words, the make of gas per ton was 11,026 cubic feet, as compared with 10,909 cubic feet in the previous twelve months. At the same time, the unaccounted-for gas was reduced from 8·56 per cent. to 7·9 per cent. The increase in profit at Longton over that of the preceding year is £659; and £2500 has been handed over to the borough fund. The "Staffordshire Sentinel" remarks that Longton enjoys the advantage of having both the gas and electricity concerns under one management. It certainly seems clear that the latter, at any rate, gains substantially from the partnership. We are told that "the gas-works have further relieved the rates by materially assisting the electricity department. All deficits hitherto incurred in the development of the undertaking have been defrayed by the gas-works; otherwise they would have fallen upon the rates or remained as a dead-weight, to be liquidated later on." The gas-works capital account at Longton is being steadily reduced; interest and sinking fund charges, which amounted to 1s. per 1000 cubic feet of gas sold, having now been brought down to 10½d.

NOTES FROM WESTMINSTER.

DIRECTLY it is seen that Private Bills are receiving the Royal Assent, then we know the beginning of the end of the session's work in which there is concern for us has arrived. Several Bills have now completed their parliamentary journey, and have reached the dignity of Acts. Among them are to be found the Removal of Sulphur Restrictions Bill; and Bills promoted by the Mitcham and Wimbledon, Maidstone, Falmouth, Basingstoke, Shanklin, Grays and Tilbury, Brockenhurst, and Boston Spa Gas Companies. On Thursday the proceedings on the Hull Bill commenced, and were completed on Friday, with the result that we expected from the House of Lords. Water measures also had a fair innings during the week.

Overthrow of the Hull Purchase Scheme.

The representatives of the East Hull Gas Company left the presence of the House of Lords Committee over which the Earl of Donoughmore presided with their title to continued possession of their undertaking completely ratified; and they may now fully enjoy and use, in the interests of the undertaking and the consumers, the powers which Parliament gave them last year, but which were placed provisionally under suspension. The gas section of the Bill only occupied part of Thursday's and Friday's sittings; and during that time all the Committee heard, in addition to an impassioned and eloquent address by Mr. Balfour Browne on behalf of the East Hull Gas Company and of statutory private enterprise generally, was the case of the Corporation for purchase. That case killed the gas section of the Bill, as it would have done before any unbiassed tribunal. It was the same case that we heard some three months ago. A Company supplying gas at a lower rate than the 2s. 6d. charged by the Corporation in another part of Hull—that is to say, at the present time at 2s., formerly at 2s. 4d., reduction to which was from 2s. 6d. (at which price the Company had been supplying from the year 1900)—was charged with want of consideration to the inhabitants in their district, with doing wrong in exercising some time ago their legal power to distribute new issues of capital among the shareholders at par, and with having an unconscionably large leakage account. These petty charges were answered in the Commons. Their discovery only dates from the time the Corporation promoted their Purchase Bill; for in 1906 there was honest and good speaking in the Committee-rooms on the part of the Corporation as to the management of the Company. Whether the Company will be able to maintain the 2s. price, of course, depends on the altered condition of the coal market; but a 2s. 4d. price cannot be called unreasonable in view of the Corporation's 2s. 6d. As to the former distribution of capital at par among the shareholders under the authority of Parliament, that act is only one side of the question. The expenditure of the capital is also of importance; and that in this Company it has been well expended is shown by the price charged for gas, and also by Mr. E. H. Stevenson's testimony for the Corporation as to the excellent condition of the plant when working up the Police and Sanitary Committee to a benevolent frame of mind regarding the period for the repayment of the purchase loan which will not now be required. Regarding leakage, too, on the same occasion, Mr. Stevenson considered that "the mains were in good order, judging by the unaccounted for gas." In all respects the answers to the allegations made have been provided by the Corporation's own case and witnesses. On Thursday and Friday there was much talking round about these matters; but nothing new could be discovered in the speech of the Hon. J. D. Fitzgerald, K.C. (with whom were Mr. Ram, K.C., and Mr. Jeeves), or in the evidence of Mr. F. J. Bancroft, Mr. E. H. Stevenson, or Mr. Charles Hunt. Mr. William Cash, F.C.A., was also on the same side. All points were exhausted in the House of Commons. The estimation by the Lords Committee of the case was such that they absolutely ignored the presence (after Mr. Balfour Browne's opening for the Company) in the witness chair of the Company's Engineer (Mr. J. Holliday); and, without asking for the room to be cleared, they conferred round the table, and announced that they were not prepared to proceed with this section of the Bill. And in these half-a-dozen words they deprived all in waiting of the interest that would have been gained from the evidence of Mr. Corbet Woodall, Mr. Arthur Valon, and Mr. Holliday. But the Committee had heard enough; and the win of the Company and the confusion of the Corporation were, in consequence, greater than if the case of the Company had been followed to the end. However, the important point in these proceedings is that the House of Lords will not have forced sales without full and fair reason; and only on such a line of action can justice to existing interests and past legislation be done. With Mr. Balfour Browne for the Company were Mr. Honoratus Lloyd, K.C., and Mr. A. M. Paddon.

Annfield Plain Gas Bill.

With reference to the note on this Bill in last week's issue, it has been suggested to us that an explanation should be made, in order that the injustice should not be done to Messrs. Schultz and Comins of causing readers to suspect that they have, in the proceedings on this measure, been contending for anything more than the fair value of the property to the Company (in which they will be financially interested as shareholders to a substantial extent), or for anything more than the money that they have actually expended. Reference to the verbatim report of the proceedings enables this now to be done. But before alluding to this special

matter, we would have it perfectly understood—our previous remarks have, we hope, made this abundantly clear—that the position of the firm and their honourable connection with the gas industry detaches them completely from the company-promoting coteries that have made the gas industry of late the seat of certain disgraceful operations. The success of the Annfield Plain Bill, despite the character of the opposition in both Houses, carries its own weight of testimony for those who were engaged in the promotion of it.

The main point, however, to which attention is directed relates to the remark of last week that, subsequent to the printing of the Bill as originally deposited, the promoters introduced a clause which would have considerably curbed the arbitrator when determining the price the Gas Company were to pay the vendors for the property and the works executed by them. The clause to which reference was being made has never, however, been incorporated in the printed Bill; and it never got farther than a manuscript condition and a mere suggestion. Part of the terms of the clause were as follows: "Provided further that the purchase price when settled by the said arbitrator shall be paid and satisfied as to the sum of £10,000 by the issue by the Company to the owners of the original capital in the Company, and as to the balance in cash, or, at the option of the Company, by the issue by the Company to the owners of fully-paid ordinary or preference shares, at the option of the Company, in the additional capital," and so on.

Well, it may be remembered the contention of the opposition to the Bill was that the works and property were not worth what Messrs. Schultz and Comins had given for them, and that this clause was clearly a direction to the arbitrator to award them something more than £10,000, and that the £10,000 was intended —anyway at first—to be in original 10 per cent. capital. But right in the opening speech of Mr. Honoratus Lloyd, K.C., when the Bill was before the House of Commons Committee, we find that the promoters had, on his advice, relinquished the idea of original capital, and asked that the whole of the capital should be 7 per cent.; and in his closing speech before the Commons Committee, learned Counsel voluntarily and definitely renounced all parts of the proviso—including the £10,000—that were considered to be a direction to the arbitrator. It will be seen from this that Messrs. Schultz and Comins—while in the first place, by the framing of the manuscript clause, they gave an indication of the minimum sum to which they considered they were entitled—were not persistent even to the point of getting a decision from the Committee on the subject, but only desired a fair award. However, the proviso inserted by the Lords Committee, though it does not mention any specific sum, virtually gives the vendors all that they were asking in the manuscript clause, inasmuch as the purchase price is now ordained to be the total of the actual sums paid by the owners for the lands, gas-works, and property, with actual costs and out-of-pocket expenses, and the fair value of all works executed by them since the acquisition—the purchase price to be settled by a single arbitrator.

The Purity of the Bure. The Great Yarmouth and Lowestoft Water Bill is still in the balance. A large amount of contradictory evidence has been given, before Sir Joseph Leese's Committee, as to the suitability or otherwise of the River Bure as a source of supply. The evidence has been completed; and Mr. Balfour Browne is to be heard to-day on behalf of the two promoting Companies. The Companies have fought so long and strenuously for their joint scheme, and the Great Yarmouth Corporation are apparently equally persuaded that they have right on their side in preventing the Companies taking this water, that the Committee (though the scheme has satisfied the House of Lords) are, it seems, determined to give it their fullest consideration. When they have announced their decision will be time enough to make further reference to the proceedings.

Birmingham Water for Coventry. The Coventry Corporation have finally carried their Water Bill through Committee, albeit stiff little contests in both Houses. The North Warwickshire Water Company met the Corporation before Major Seeley's Committee last week; their contention being that the Corporation are going to spend a lot of money in laying a pipe to take water from the old Shustoke reservoir of the Birmingham Corporation (which water Birmingham do not want now that they have their Welsh supply), that the water is of questionable quality, and that the Company are themselves prepared to supply them more cheaply and efficiently with a pure supply. The minimum price Coventry is to pay Birmingham for the accommodation is £5000 a year (the rate being 4d. per 1000 gallons); and there is a proviso that should the water at any time become impure, Birmingham will supply Coventry with Welsh water. This is important when one considers the statement of Sir Alexander Binnie in the course of his evidence that the water proposed to be used by Coventry is "ten thousand times" more polluted than the Thames. The issue of the proceedings was indicated well before they ended by a laconic expression of the Chairman's opinion that the opposition was of "a flimsy character." That the water is not so bad as it was painted was well proved by the technical evidence advanced both from Birmingham and Coventry. The only conditions affixed to the passing of the Bill were that certain suggestions by the Local Government Board should be carried out, and that outside areas should not be charged less than the rate in Coventry.

Unhappy Conditions. The Heywood and Middleton Water Board have been unfortunate. They are building an extensive new reservoir which will greatly enlarge their resources; but, through faults in the strata, they have had to carry the foundations down some 50 or 60 feet lower than was anticipated. Capital expenditure has, in consequence, been enormously and unavoidably increased. The Board have apparently had a run of bad luck; for it is alleged that the water-rates in Heywood and Middleton are the highest in the country. Any other town wishing to lay claim to this unenviable distinction may like to know that the Unopposed Bills Committee of the Commons were last week informed that in Heywood the water-rates range from 10 to 7½ per cent. upon the gross rental, and in Middleton from 12½ to 10 per cent. The provision of the water supply therefore presses heavily on the people of those towns; and unfortunately further borrowing powers—the principal object of the Board's present Bill—are required for the reservoir in hand. We can hardly see the reason for the Unopposed Bills Committee inserting a clause in the Bill to the effect that the Board shall not sink any wells or intercept any water otherwise than by works expressly authorized by Parliament or by any statutory provision. It is, however, a harmless kind of thing, as it is hardly likely the Board would exceed their powers in this respect.

Scotch Water Waste. The Renfrewshire County Council and the Glasgow Corporation and others are in opposition before Major Seeley's Committee over a scheme which the former are promoting, whereby they propose to purchase the undertaking of the Busby Water Company (who are willing sellers) and to construct reservoirs at Bennan Loch and Loch Craig for the upper district of the county. The Glasgow Corporation had a rival scheme, which was rejected by the House of Lords; and so they are before the Committee of the Commons as opponents of the Renfrewshire Council. It is hinted that, at the back of the Glasgow Corporation's opposition, is a fear that the passing of the Bill may weaken their case for annexation. On the new works, the County Council propose to spend £46,500. The evidence has been largely directed to showing that Glasgow cannot—but they deny the allegation—supply from their existing works the higher levels of the district in question; while the promoters of the measure affirm that their scheme will do all that is necessary. In the Busby Water Company's district, the waste of water has been going on at an alarming rate; and certainly there is room for the people mending their ways in this connection. To this the County Council want an opportunity for giving some attention. On the occasion of one measurement by Sir W. R. Copeland, the consumption of water was proceeding at the rate of 70 gallons per head per day; and Mr. James Watson has made the interesting calculation that 71 gallons a day for each inhabitant in a house containing a family of five, means that every day 1½ tons of water are being pumped into the house. This totals to several hundred tons a year. According to our Scotch Correspondent, an agreement has been come to between the promoters and the Glasgow Corporation. The proceedings are going to be continued to-morrow.

PERSONAL.

Mr. Baldwin Frankland, Chief Assistant to the Water Engineer of the Leeds Corporation (Mr. C. G. Henzell, M.Inst.C.E.), has accepted the position of Manager of the Weymouth Water-Works.

In response to the invitation contained in the "Journal" for the 18th ult., no less than 190 applications were sent in for the position of Manager and Assistant-Secretary of the Banbury Gas Company; and out of them Mr. J. R. Duff, of Morecambe, has been appointed.

At the meeting of the Stockport Town Council last Wednesday, the Gas Committee reported that they had selected, out of 196 candidates, Mr. William Blundell, of Southport, to fill the position of Chief Clerk to the Gas Department, in succession to Mr. T. Bedford.

Yesterday (Monday) week a meeting of the employees of the Nine Elms works of the Gaslight and Coke Company was held to wish Mr. Frederick Beale good-bye, and to present him with a token of their regard and esteem. The presentation was made by Mr. Wilton, his assistant, who, in a very able speech, expressed the feelings of the meeting. In reply, Mr. Beale thanked all present for their kind wishes for his welfare. The gift was a very handsome silver rose bowl, suitably inscribed.

After a very considerable tenure of the office of Chairman of the Brentford Gas Company, Mr. Howard Charles Ward has surrendered it to one of his younger colleagues—Mr. Ulick J. Burke. Mr. Ward, however, is not severing his connection with the administration. His services for the Company have been so long and distinguished, that his colleagues would regret to be denied his counsel and experience while health permits. The vacancy on the Board occasioned by the death of Mr. Frank Morris has been filled by the election of Mr. William King, of Liverpool. The Board have done wisely in continuing technical representation.

The death occurred on the 3rd inst., in his 60th year, of Heer Dirk van der Horst, of the Amsterdam Gas-Works.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 124.)

The course of things on the Stock Exchange last week was not absolutely unchequered. The arrest of improvement was but brief, however, and afterwards the general recovery which we were able to note in our last issue proceeded to solidify itself. Business is not yet booming; but it is getting steadily brisker and more active. The opening day last week was very quiet; but from the start the tone was encouraging. There was evidence of a fair amount of investment purchasing, and prices in many lines were rising. But on Tuesday the advance sustained a check. One or two queer rumours were set rolling; and, as the markets had not quite thrown off their old sensitiveness, a relapse ensued. Consols fell ¼ on sales. The depression prevailed on Wednesday, aided by the dismal weather, which was bad for railway traffics, and Consols fell another ⅛. Next day, however, the better tone recovered itself, and cheerfulness reigned once more. Buyers came in to the support of markets, and prices rose again. This happier state of things prevailed on Friday and Saturday. Business became more active, the improvement in the weather helped railways, and generally in pretty well every department there was a nice tone that endured up to the close. In the Money Market, the turn of the half year made money very easy at first. But as the week progressed, the demand became stronger; and rates were firmer and closed steady. Business in the Gas Market was a fair average in the aggregate, but was irregularly distributed through the week; some days being a great deal more active than others. The market participated in the cheerful tone which prevailed generally; and a good many important issues improved in price. In Gaslight and Coke, the ordinary was brisk and strong. Opening on Monday at 94¼, it steadily advanced to 96, at which figure several parcels of stock changed hands—a rise of 1 in quotation. The secured issues were not much noticed, and were unchanged. The maximum marked 88½ and 90, the preference 104 and 105, and the debenture from 83¼ to 84. South Metropolitan was less active, but improved in strength; the quotation rising 1½, with dealings at from 119 to 120½. The debenture was a point lower, at from 82 to 83½. Nothing at all was marked in Commercials. In the Suburban and Provincial group, Alliance and Dublin was done at 20¼ and 20⅝, Tottenham "B" at 101¼ and 101½, ditto debenture at from 100½ to 101, Wandsworth and Putney "B" at 133½, and West Ham preference at 122½. Brentford old rose 3; and on the local Exchanges, both Liverpool "B" and Newcastle advanced. The Continental Gas Companies were much quieter. Imperial rose a point, with business marked at from 172 to 174. European fully-paid marked 23⅛ and 23¼, ditto part-paid rose ½, and Union was not dealt in. Among the undertakings of the remoter world, Bombay changed hands at 6¾ and 6⅝, Buenos Ayres at 11⅛ and 11 3/16, ditto debenture at 94½, Primitiva at 7, ditto preference at 5 3/16, ditto debenture at from 94¾ to 96, River Plate at 13 and 13 1/16, and San Paulo at 12 13/16.

ELECTRIC LIGHTING MEMORANDA.

Continuity of Management—Powers and Decisions of the Local Government Board—Disposal of Surpluses—London County Council Incensed—Net Profit Atoms at Hastings—A Rate-in-Aid through Street Lighting—Undischarged Accommodation.

The Incorporated Municipal Electrical Association have been meeting in Sheffield, under the presidency of Mr. S. E. Fedden—a gentleman whom we admire, and who has the sympathy of his professional brethren in that he has to conduct a municipal electrical undertaking with a Gas Company uncontrolled in the lowness of the price at which they may sell gas, successfully opposing, by their modest views as to charges, all the efforts of the municipal electricity department to make really substantial progress. Another cause for sympathy is that some impertinent inquirers into the affairs of the department have discovered that, though the salaries bill amounts to £5201, only £1348 is visible in the accounts. They are asking whether the staff has been paid, and, if so, who has befriended the department. However, more of this when the mystery has been cleared up. Meanwhile we see, in his presidential address, that Mr. Fedden has been teaching his masters their business, and inferentially suggests that, in the continuity of the management of private enterprise by Boards of Directors, we have a far preferable system to that which exists in the case of the management of municipal trading undertakings. This is a fair deduction from his statement that the continuity of chairman and principal members of committee is essential to the successful development and well-being of a municipal department, and particularly so in the case of electricity supply where the intricacies of working cannot be grasped in a short time. Mr. Fedden's ideal continuity is all right so far as it goes. But local government has not been constructed on a basis that provides for such continuity, nor would it always be advisable for the happiness of officials and the well-being of undertakings for some councillors to be installed in perpetuity—so far as human capacity would allow—in the places of honour and influence. Municipal electrical engineers no doubt (like the chief officials of other municipal departments) can point to a few despots—conceited and high-handed—for whom they have often mentally wished a speedy release from the further claims of public office, if not a complete transference from this terrestrial ball to some other place. To such individuals, the continuity pleaded for by Mr. Fedden would be flattering and agreeable; to the chief officials concerned, the bare vision of such continuity would be an ineffable horror. However, given good men, the principle is one that would certainly be advantageous.

There were many subjects touched upon, briefly but seriously, by Mr. Fedden in his address. He echoed the view of municipal electrical engineers—especially of those who, through the miserable condition of their department's finances, have had to go under the harrow of the Local Government Board—that the Board and their Inspectors are clothed with very comprehensive powers, which are sometimes found rather inconvenient by municipal authorities with electricity undertakings hanging round their necks. We are persuaded, from a careful study of the proceedings of the Board in this connection, that it has been a good thing for many communities that the Board have such comprehensive powers. Mr. Fedden again does not like the recent practice of the Board in only sanctioning loans for specific purposes. In electricity undertakings where the constituent parts of the plant and appliances have such widely variable life, it is impossible for the Board to satisfactorily consolidate loans and equate the periods of repayment. They did this at one time; but it did not work fairly, and many an electricity undertaking is in consequence the worse off to-day. Another question has reference to the payment of permanent employees engaged on capital work. The Board have resolutely set themselves against the practice favoured by municipal departments of paying such employees out of capital. It is true the financial advantage is on the side of the undertaking by the charge being made against revenue; but we are not at all sure that it is politic for the Board to be too insistent on the point, as it will be an inducement to having all work executed by contract when, in slack seasons, on some classes of employment, the permanent hands might well be kept fully engaged. There are, however, considerations affecting both sides. The President of the Local Government Board has declined to receive a deputation on the subject; and the House of Commons is to be moved on the matter on the occasion of the presentation of the estimates of the Board. We are glad to find that Mr. Fedden does not believe in handing over surpluses in aid of the rates, although he has not been troubled much with surpluses for disposal in any manner. He considers that, when a suitable reserve fund has been accumulated to deal with premature antiquation of plant and unforeseen expenses, any surplus might be devoted to street lighting and reduction of tariffs to consumers. He had better, with gas at the Sheffield price, be prudent, and leave street lighting alone—devoting any surplus he may succeed in obtaining to a reduction of price to private consumers. He has a good example in the Sheffield Gas Company.

The feeling expressed in our editorial columns last week also strongly possesses the London County Council, that their Electricity Bill met with its end purely on political grounds, and not on its merits as a means of giving—what is believed by some people to be necessary—a bulk and power supply of electricity in London, without risking the ratepayers' money or hypothecating the credit of the Council. The Parliamentary Committee presented last Tuesday a report to the Council on the subject of the summary dismissal of the Bill; and certain of the statements in the report were obviously merely gossamer coverings of more acute feeling. "We can only hope," the Committee modestly remarked, "that the needs of consumers of electricity in London, and the wishes of the ratepayers have not in the present instance been made subservient to the political convictions of the [Hybrid] Committee." The Hon. W. Peel, in moving the adoption of the report did not evince the slightest reluctance in presenting the position in a much stronger light through the employment of unequivocal language. He frankly declared that the real reason for the rejection of the Bill was that it was promoted, supported, and furthered by the Municipal Reform party. There is no doubt that Mr. Peel is right. The matter, however, is really a larger one than the mere rejection of this particular Bill. It is Parliament setting itself against the seriously expressed wishes of the people, on a straight issue, at the polls. If this is to be the mode of legislation under the present Parliament, there will be little use anyone who is not of the same political view as the Government promoting Bills of a controversial nature; for it is plain that they will not be dealt with judicially, but politically. Under the circumstances, the County Council being pledged to the people of London not to run any financial risks in this matter, it is useless for them to approach the question again; for what will please the ratepayers will not please Parliament, and what will please Parliament will not please the ratepayers. The Council are not at present proposing to do anything more in the matter (although there is plenty of time before the next Bill-depositing season comes round); but they have recorded their deep regret that the Bill has been rejected, "thereby depriving the elected representatives of municipal London of the opportunity of securing the provision of a cheap supply of electricity, subject to public control."

When the accounts of municipal electricity undertakings are published, they often let light in on past events. At Hastings, during the last few months there has been a fresh outbreak (in print) of the gas-electricity controversy; and the accounts of the Corporation Electricity Department just published show how

sorely the undertaking is in need of all the puffing of the virtues, and repressing of the demerits, of electricity that the wit of the hard-pressed Electrical Engineer can devise. The accounts impute to the electricity undertaking the making of a net profit of £198, against £117 the previous financial year. Of course, if the electricity undertaking had any susceptibility on the point of honour, it would rise up in righteous indignation, and repudiate the making of these particles of net profit in a fair and square manner. Take one point only. In 1906, the Gas Company paid in local rates and taxes £2762 on a gross profit of £23,977, or 2s. 3½d. per £1. The Electricity Department paid £250 for rates and taxes on gross profits amounting to £10,606, or 5½d. per £1 only. If the electrical undertaking had paid at the same rate as the Gas Company, there would have been a deficit of at least £1000 last year. But what about the current year? The new lamps in the streets are consuming less electricity; and the price of fuel has gone up. The charge for current, too, to private consumers has gone down—the Electricity Committee finding that the high prices of the past are no longer maintainable. In comparison with other towns of the size of Hastings, the figures are still high—ranging as they do from 5¾d. to 4¼d. per unit, according to quantity used. The Committee will have something to do to get through this year without a deficit, especially if they insist on levelling up the rates and taxes to the line the Gas Company have to toe. A correspondent in a local paper suggests that this over-indulged municipal concern should be disposed of or leased to a company.

On the subject of the contribution that street lighting makes to the support of electricity undertakings in many places, an instance is found in the report of Mr. Carson Roberts on his last audit of the Islington Borough Council's accounts. The ratepayers will read with some surprise, not unmixed with sorrow for themselves and displeasure with the old Borough Council, that the charge made for current by the electricity undertaking of the Council for street lamps is at the rate of 3·31d. per unit, which is twice as high as the average amount charged in other Metropolitan boroughs. The Electrical Engineer agrees that about 1¾d. would be a reasonable and fair charge. Mr. Roberts adds: "The charges for public street lighting represent in this case a full third of the gross income from the sale of current, and means in effect that a rate contribution in aid of the undertaking to the extent of about £7000 per annum is now being treated in the accounts as payment for street lighting." There is no need to attempt to add to the cogency of this statement. A Special Committee of the Shoreditch Borough Council have discovered another way of reducing the cost of street electric lighting, other than by reducing the cost per unit. This Committee have recommended that the illuminating power of the arc lighting in six circuits should be curtailed by 20 per cent., at an estimated cost of £150. The ultimate saving is calculated at £750 per annum.

There was a Local Government Board inquiry just recently at Belfast regarding an application for £75,000 for the extension of the electric lighting undertaking; and such a good character was given the Inspector as to the "sound financial position" of the concern that it may be suggested the time has arrived when the financial accommodation rendered by the Gas Department in the years of tribulation of the electricity undertaking might be discharged. It was stated that the Committee are now in a position to set aside for depreciation and renewals 9·3 per cent. of the capital, which is much above the average of municipal undertakings. The net profit for last year, after paying interest and sinking fund, amounted to £11,478. The cost of production, too, is extremely low; and the published returns show that the Belfast costs for last year—0·634d. per unit—are the fifth lowest in the kingdom, notwithstanding the present high cost of coal in Belfast. Assuredly the concern is now in a position to discharge its obligation to the competing undertaking.

Molybdott.—It is reported from Paris that a young student at the School of Medicine at Rochefort—M. André Lancien—has made the remarkable discovery of a substance which he calls "Molybdott," and which is said to possess the same properties as bromide of radium, but costs only 20 frs. instead of 3000 frs. per gramme. The Academy of Sciences has already been informed of the discovery.

The Patents Bill as Amended.—Some weeks ago we noticed the publication of a pamphlet by Messrs. Ernest Lunge and Bernhard Dukes containing some critical notes on Mr. Lloyd-George's Bill to amend the law relating to patents and designs. Since then the Bill has been considered by a Standing Committee of the House of Commons; and a second edition of the pamphlet was issued last Friday, containing the Bill as amended. The Committee have nearly doubled the size of the draft Bill by the insertion of new clauses and sub-clauses which, in the opinion of the authors of the pamphlet, have not improved it. They say that the original Bill threw the law of patents into anarchy and confusion. The Standing Committee, we are told, have done worse, for "they have gutted the rights of patentees, and made the British letters patent a document deprived, by the texture of the paper prescribed, even of utility for pipe-lights." For the justification for this strong statement we must refer those of our readers who are interested in the subject to the pamphlet itself, which is being published by Messrs. Stevens and Sons, Limited, Nos. 119 and 120, Chancery Lane, at the price of 1s.

THE CENTENARY OF GAS LIGHTING.

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Lighting, both for public and for private purposes, has been, and will ever be, a highly controversial subject. In fact, it has been so ever since the time of the curfew, or when the citizen was compelled to light that portion of the street which was outside his own house, by exhibiting a "lanthorn" over his door, between the hours of sunset and midnight, on certain nights of the year, defined in the calendar by the Festivals of Saints, whose natal days occurred in that period which was of the darkest. When a man should go to bed, and how much he should contribute to the common weal, in oil or tallow, for the benefit of those whose business or pleasure kept them out of their houses after sunset—these were matters which, in those early days, continually agitated the public mind.

Old records inform us that the Commonalty, as expressed by the elected representatives, and those who elected them, were continually at variance as to the effectual lighting of the public streets. One edict was to the effect that every citizen should exhibit a candle over his door.* The law was obeyed, but the candle was not lighted. A further regulation, it is said, was made that everybody should light the candle by law "exhibited." He did so; but after it had been lighted, the wind would blow it out, and the citizen saved his tallow. The regulation was then amended and it was decreed that all should hang lanterns over their doors. This was quickly done; but as nothing was said about candles, they were left out. The authorities went over the ground again, and decided that the lanterns should have candles therein. Once more the law was obeyed; but the candles were not lighted. It was next decreed that the lanterns should be lighted; and careful citizens only put in very small pieces of candle which soon burnt out. The length of the candle to be lighted was then specified; but the controversy has never ceased. Instead of being fought around "candles," it has waged around "candle power," with an intensity that makes the battles of those crucial days appear quite small things. So badly were the public streets lighted in the days of "Bluff King Hal," that highway robbery was committed with impunity. "Hang up the thieves, and let honest men stay indoors," was the King's advice; and so well was it carried out that it is stated that no less than 72,000 persons were hanged in his reign.

In these articles, it is proposed to omit the earlier references to the discoveries and manufacture of gas by Murdoch and those immediately preceding him, and rather to chronicle the history of gas lighting during the past hundred years. This month of July, 1907, well deserves to be termed an epoch-marking period in the history of gas-lighting, completing as it does the Centenary of the introduction of gas lighting as a practical means of illuminating the streets in the centre of the Metropolis. True, a little earlier, in the year 1803, Frederick Albert Winsor, a German by birth, lighted the Lyceum Theatre with gas; and on Jan. 28, 1807, a display on a large scale (judging by the prints published at that time) had been provided by Winsor in Pall Mall, for the benefit of the West End. While the crowd still lingered and gazed at "the long line, between St. James's Palace and Cockspur Street, that did blaze out in a burst of gas-lamps to the no small wonder of the public," and Sir Walter Scott, in writing of Winsor, was saying "There is a madman proposing to light London with—What do you think?—Why with smoke!" and while even Sir Humphry Davy and both the popular and scientific Press were expressing hesitation at the proposal, the City Lighting Authority not only considered, but had had installed, a practical demonstration of street lighting in their area. In a circular dated July 10, 1807, the Clerk to the Lighting Commissioners states that: "Having had an offer to try the experiment of lighting the public lamps with gas, the same will be put into execution in Golden Lane and Beech Street, in the Ward of Cripplegate Without, Monday night next, and continued every night until the following Monday (July 15 to 22)." The experiment was so satisfactory that it at once became the permanent illumination.

In 1808. Murdoch presented to the Royal Society his account of the application of gas-light for which he received Count Rumford's Medal. In the year 1810, the indefatigable Winsor, after much opposition and many defeats (being strongly opposed by Murdoch in his endeavour to start the National Light and Heat Company), succeeded in obtaining an Act of Incorporation, entitled the "Gas Light and Coke Company," with a capital of £200,000. The enterprise was looked upon as visionary, though the Royal Charter was granted to it in 1812. Yet the privileges of the Charter were neither liberal nor encouraging; the powers granted being extremely moderate, and the restrictions many. The Gas Light and Coke Company thus established commenced operations on a site now occupied by the Civil Service Institution, in Cannon Row, Westminster. But not much was done in the practical application of gas as a lighting agent; and just when the promoters were losing heart, the Company were fortunate in securing the services of Clegg, as Engineer, who brought his experience and genius to the task of surmounting the obstacles that lay in the path of progress.

In December, 1813, Westminster Bridge was first lighted by gas; and the year after, the oil-lamps were removed from the

* "Sermons in Candles," by C. H. Spurgeon.

streets of the parish of St. Margaret's, Westminster, in favour of gas-lights. In 1815, the Guildhall was lighted by gas; and the public Press teemed with the most extravagant praise of it—"as shedding a brightness clear as summer's noon, but undazzling and soft as moonlight, though forming a magnificent combination worthy the inauguration of the presiding citizen." The year 1816 found a large part of the Metropolis illuminated by gas; more than 4000 argand burners having been put up, while arrangements were being made for a large extension. At this date, the total length of mains in London was about 26 miles.

The apparent slight that had been thrown upon this new branch of civil engineering may have kept some sensible and well-disposed persons from wishing it a success, and have somewhat retarded it. But now a considerable advance seems to have been made with the new light. The avenues to the House of Lords and House of Commons, the residence and offices of the Speaker, the Mansion House, and many important places, adopted gas at this period. To gather an idea of the rapidity of main-laying, the gas historian of that time states that the Liberty of Norton Folgate, as far as Bishopsgate, was lighted with gas from the Chartered Company's station at Norton Folgate; and pipes were laid from that station as far west as Cheapside, and all streets north of that thoroughfare. In the West-End, the mains for supplying the streets and houses by the Gaslight and Coke Company extended northwards through the most eligible parts from their establishment in Peter Street, Westminster, along the line from Pall Mall to Temple Bar, completely surrounding the area of St. Martin's-in-the-Fields. "Main pipes" were also laid in the Haymarket, Coventry Street, Long Acre, St. Martin's Lane, and the Parishes of St. James and St. Ann.* In the East-End of the Metropolis, mains extended from Cornhill to St. Paul's, Wood Street, Fore Street, &c. Consent had also been given to the Incorporated Gaslight Company for laying pipes in the parishes of St. Paul, Covent Garden, St. Mary-le-Strand, St. Clement Danes, St. George, Bloomsbury, St. Giles-in-the-Fields, St. Andrew, Holborn above the Bars, part of St. Mary-le-Bourne, and the whole of the City and suburbs of Westminster. Still farther East, the same Company were engaged laying their pipes in the principal parts of Whitechapel, Spitalfields, and St. Luke's. One part of the City of London, from Temple Bar to the west end of Cheapside, from Newgate Street to Holborn Bars, together with the neighbouring streets, was also provided with pipes laid down by another Gaslight Association, who had opened a new establishment in Water Lane by Fleet Street, but were unconnected with the Chartered Company. A third Company was projected in Southwark, and a fourth in the East of London, "creating a rivalry of interest—that laudable competition which always proves beneficial to the public at large, and which cannot fail to accelerate the progress of the new art of procuring light." If Accum, the writer of these remarks, could have foreseen the chaos and ruin, as well as the set-back to the gas industry, that followed this wasteful competition, he would have considered before using this closing sentence. Clegg, under whose direction the new system of lighting was being principally carried out, speaking in 1816 of the progress made with the work, said that the main pipes of his Company alone amounted to nearly 15 miles; while it is interesting to learn that one church in the Metropolis had been illuminated with gas-light for upwards of two years, "the lights employed in this edifice being equal to 360 tallow candles, eight to the pound."

"Enough, therefore," says the early writer, "has been done to prove the possibility of lighting house and street with gas, which would have been regarded twenty years ago as an extravagant paradox. From the distinguishing forms which the flame is capable of assuming, no light is better calculated for signal lights. If every lighthouse around this island were possessed of a gas-light furnace, one-half of the enormous expense of the present lighting would furnish a much more brilliant light. Another application of gas would be the lighting of barracks, arsenals, &c.; the annual expense of lighting the barracks of Great Britain being about £50,000, a small part of which, on the new plan, would supply a much purer and safe light. The uses of the lights enumerated must of themselves justify in attaching great importance to the discovery, and if reduced to practice all over the Kingdom would employ a large capital in a way the most advantageous and productive."

Illumination by gas was now beginning to make headway; but it was not to be expected that the event, however practicable, of extending it to the dwelling-houses of every town and village should take place at once. Prejudice had to be eradicated, and established habits altered—all of which was a work that nothing but time could effect. The education of a whole generation of men had to be accomplished before such a theory of lighting could be established, so slowly at that time did improvements of any kind make their way into common use. Here was an invention calculated to economize labour and increase comforts, which was neglected to be taken advantage of. Other circumstances besides prejudice were unfavourable to the new invention—ignorance, vested interests, jealousy, malice, all of which so often obstruct the progress of improvement and prevent plans coming to fruition for the public good. Such a revolution as gas lighting was going not only to alter domestic habits, but to give a new direction to part of the skill and capital of the country.

* Accum's "Practical Treatise of Gas-Light" (1815) and "Description of the Progress of Manufacturing Coal Gas."

In mustering their full strength against the introduction of the new form of illumination, an endeavour was made to move the public mind, by dismal forebodings of the Greenland trade and the loss of the nursery of British seamen. The objection to the Greenland industry was futile. The nature of the Greenland service required that the crews should consist chiefly of able-bodied sailors; and being "protected" men, not subject to "press" for the Royal Navy, they were rendered useless for National Defence. And even on the extreme supposition that the gas industry was going to put an end to the Greenland fisheries altogether, "was there," says Accum, "much to regret in it? Why fit out vessels to navigate the Polar Seas for oil, if we can extract a superior article for procuring light at a cheaper rate from the produce of our own soil? The fisheries will find ample encouragement; and the consequence of the lighting of our streets with gas can prove injurious only to our Continental friends, one of whose staple commodities—tallow—we shall then have less occasion to purchase." So strong was the opposition, that Lewis Thompson, in a paper on "Coal Gas, and Its Application Considered for the Purpose of Generating Light and Heat," written in the late fifties, said: "It has long been remarked as a matter of surprise by intelligent foreigners that in a country like Great Britain, where the Arts have attained an unprecedented development, there should be one incessant struggle, one prolonged fight, betwixt ignorant prejudice on the one hand and practical knowledge on the other—in fact, betwixt darkness and light. In return for the promulgation of an idea, which now illuminates every large town in Europe, Winsor received the jeers, the scoffs, and even the hate of those he tried to benefit. He met with an opposition as furious as it was uncalled for, and no doubt felt the benumbing influence of popular discouragement, though supported by a noble body of Directors, evidently not unsuited to the trying nature of their position. It is, of course, very difficult in the present day to guess at the progess which might, under favourable circumstances, have been made by Winsor alone in the manufacture of coal gas; for he certainly understood the whole subject, and might have placed it considerably in advance of its existing condition, had Society been then capable of receiving it. But he was checked on all sides, and experienced none of that enthusiastic national sympathy which has so lately given so glorious an impetus to our railway system. On the contrary, he had to conquer every inch of the ground which he wrung from public prejudice." Thus the early opposition to gas lighting was nothing more than the common clamour always set up against every new means of lightening labour.

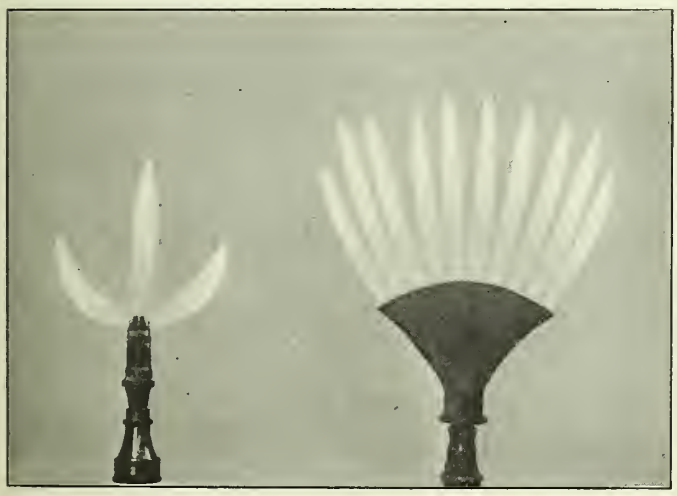
At this time (1816) it was laid down as a rule that no private individual resident in London should attempt to light his premises for the sake of economy with coal gas by means of his own apparatus whose annual expense for light did not exceed £60. From experiments made by Clegg during the first eight years of gas lighting, on the effects produced by a number of gas-lights of a certain intensity, he had reason to believe that streets of small towns might be illuminated at a cheaper rate by means of a tower or pagoda, than could be done in the ordinary way by street-lamps; the gas being conducted to the top of the building, and the light directed down by reflectors at certain angles. By this means, the mains and services were to be saved, to compensate for the cost of the pagoda. In 1815, it was held to be conclusive that the lighting of a parish by street-lamps only, without lighting the shops and houses, could not be accomplished with economy.

Trouble being experienced at this time with regard to the charge made for gas, Clegg, the Gas Light and Coke Company's Engineer, came forward with a remarkable invention to meet the case. He had previously, with a view to allaying any alarm on the part of the public, invented a self-extinguishing gas-tap, so constructed that the gas could not flow to the burner when the flame became extinguished; for if the flame was blown out, and the cock left open, the valve automatically shut. This action depended upon the expansibility of a metallic rod heated by the flame of the lamp, and its contraction when the flame was out. His later invention was, however, more wonderful, and is with us to-day; it was called "Clegg's self-acting gauge"—a machine which "measured and registered, in the absence of the observer, the quantity of gas delivered by any pipe connected with the gas-main." The machine occupied a space of about 2 feet by 1 foot; and "if put up in a room, house, or other place where gas was burnt, it would, at any time, by mere inspection, give an account of the quantity of gas consumed." This is a description of the first gas-meter; for at that time consumers paid for their gas by rent, at so much per light—by which we have the terms "gas rent" and "rental department." Clegg's gas-meter was further described as for "checking the conduct of workmen on the works, and enabling the manufacturer of coal gas to ensure himself of obtaining at all times the greatest possible produce from his establishment—a measure by which he can deal out the gas in whatever quantities they may require it." In those early days advantage was taken by the unscrupulous to get more than they paid for from the gas manufacturers; for we find it on record that "every person must have noticed how shamefully many disregarded the terms on which they have contracted for a supply of gas—some by means of the excessive flame they keep up, and others by suffering the lights to burn hours beyond the time." In places where gas was supplied on contract to pay for burning a limited time, by means of certain sized burners, "the seller was

always in a degree, and in some cases wholly, dependent on the care and honesty of the purchaser." On the introduction of the Clegg gauge, equal justice was done to both the consumer and the seller; and, to use the words of Accum, "the waste being transferred to those who occasioned it, the price of gas was reduced to an equitable and correct measure of value."

The benefits had a wider range; for not only was full value secured to the maker for the whole of the gas manufactured, but it became a more marketable article. In the system of charging by the year, half year, or quarter, many who were only in want of gas occasionally, or whose demand was irregular or uncertain —such as the proprietors of theatres—were debarred from availing themselves of it, except at an expense disproportionate to the amount consumed. Here we find in Clegg a man of indomitable energy and force, as well as of an inventive faculty, who saw the early difficulties of gas lighting, only to surmount and overcome them. Without his help, Winsor (with all his wonderful powers of organization and "push") would have made but little headway against the strong opposition existing; but allied to a man of experience and constructive genius like Clegg, progress was made, customers were won, and gas lighting became an established fact. Thus in 1819 the extraordinarily rapid progress which coal gas had made in the United Kingdom was, we are informed, "without a parallel in the history of the useful Arts." It was expected in these early days that the Chancellor of the Exchequer would levy a tax on the "new lights;" for it was remarked that "in proportion as gas-lights are more or less generally adopted in all towns of the country, the consumption of oil and tallow will be diminished, and the income on those articles will become less productive."

The definition given to mains at this date is not uninteresting—*i.e.*, "Cast-iron pipes, from 2 inches in diameter and upwards, placed underground for conveying gas into smaller branch-pipes, but in a more extended sense." The term is applied to every



Photograph of "Coxcomb" and "Cockspur" burners, lent by Professor Lewes.

pipe from which "smaller ramifications or branch-pipes proceed." Again, "All mains destined to convey coal gas should be proved by being submitted to the trial of sustaining a column of water 300 feet high."

The burners then in use were the cockspur, cockscomb, bats wing, rattail, and argand. The first named seemed to have consisted of a hollow globe about $1\frac{1}{2}$ inches in diameter, pierced laterally with from three to five holes of about $\frac{1}{30}$th inch diameter. Out of these, flames issued in straight jets. Naturally, the combustion was not perfect, and it was also a wasteful manner of burning gas. The hot-air currents gave the upward tendency to the long spikey flames which took the shape of a fleur-de-lys, and also caused them to curve in the form of a spur of a game-cock. The consumption of the cockspur was $3\frac{1}{2}$ cubic feet per hour; that of the batswing being 5 cubic feet. The flame of the rattail burner consisted of a long upward spike. The photograph of the cockscomb and the cockspur burners here reproduced has been lent by Professor Vivian B. Lewes, who informs the writer that recently, when in Ireland, he saw rattail burners still in use.

It is curious to note the early instructions given to the workmen in laying supplies: "Pewter, tin, lead, or other pipes capable of being melted by a gas-flame should never be employed through the interior of a house, because of the ease with which such pipes might be perforated, and the serious consequences that would ensue if the gas issuing from the aperture were lighted." Copper pipes, being cheaper in those days than iron, were largely used by the several companies; the objection to corrosion by stopping, which on the introduction of gas was complained of in many places, no longer existed, it being pronounced that pure coal gas produced no action on the copper tubes. Such copper tubes laid in London more than ten years previously, were found to be in a state of perfect preservation.

So much for the description of the work and methods of the pioneer Gas Companies, and their energetic officers—particularly Clegg, who stood head and shoulders above his compeers at that date, and who afterwards became the author of a standard work on the "Manufacture and Distribution of Coal Gas," which ran into many editions.

When the obstacles and prejudices were overcome, and large amounts had been spent on experimental work, a great boom took place. Between the years 1814 and 1819 rival companies arose, especially in the Metropolis. The Phœnix or South London Company had their Act in 1816; the City of London Company in 1817; while the Imperial Company had commenced by 1820. In 1823, the Ratcliffe Company, and in 1829 the Independent Gaslight and Coke Company commenced operations. The City Gas Company and the Chartered Gas Company were permitted under a contract with the authorities to lay down their pipes, with a distinct written agreement that at the expiration of a given time the City should be entitled at their own pleasure to purchase them by valuation. The two Companies, however, partitioned the City between them under a secret agreement known as the "Congreve Compact"* and thus established a practical monopoly.

In 1823, when London north of the Thames was being supplied by four Companies, oil gas began to attract a large amount of attention; and an attempt was made to start the London and Westminster Oil-Gas Company, to the alarm of the coal-gas industry, who opposed and petitioned against the proposal in Parliament. In 1824, Michael Faraday gave evidence in favour of the Bill; and eventually, on a report of the Inspector of Gas-Works (Sir William Congreve), investigation was made by a House of Commons Committee, to the undoing of the oil-gas project. The opposition of the gas companies to the measure cost them some £30,000, though several witnesses of the Oil-Gas Company who had had charge of oil-gas works, admitted a loss on them without the employment of coal gas as an adjunct. In spite of this, Bristol was being lighted by oil-gas in 1823 under a Special Act, in the face of warnings which in a few years were verified. In 1825 the Imperial Continental and the European Gas Companies were commenced, mainly through the instrumentality of Sir William Congreve.

Following shortly after this came one of the most remarkable periods in the gas industry, when a ruinous rivalry set in among the various companies. Many of the concerns paid not a farthing in dividends, while others were almost ruined. But this did not prevent the multiplication of undertakings. For instance, in the Metropolis, the Imperial Gas Company never paid a farthing from the time of its inception; and similar remarks apply to the City of London and Phœnix Companies. Only the Chartered Company paid a dividend; but in spite of this the South Metropolitan Company was launched in 1833, for the purpose of supplying cannel gas, and was incorporated in 1843. So precarious was its early existence, that it was seven years before the unfortunate shareholders received any profits. In 1847, it is found with a capital of no less than £19 per ton of coal, equalling about £2000 per million cubic feet sold; but by careful management this amount was reduced for the year 1860 to £550 per million feet —thus in twenty years bringing the capital charge down to about one-fourth.

In the summer of 1842, a Committee was formed to investigate the impurities of gas, and the injuries done by the products of burnt gas. The services of Professors Faraday and Brande, Mr. Aikin, Mr. Brown, and Dr. Prout were enlisted. Without going into the detail of their investigation, which went to show that oil of vitriol was the great cause of the mischief, a summary of Dr. Prout's findings may be interesting. Two equal portions of the water used in the Athenæum Club had been exposed to the air of the drawing-room of that establishment for a fortnight; and he found that it thereby acquired a striking increase of sulphuric acid, so that when it was evaporated nearly to dryness, it distinctly reddened litmus paper, and showed the presence of free sulphuric acid. "This," said Dr. Prout, "sufficiently explains the destruction of the club books; nor will there be any improvement till the gas is either removed or its fumes conducted away by appropriate chimneys." Professor Faraday and Mr. Aikin agreed in this opinion; and the Committee resolved—"That as from the above experiment it appeared that much of the injury suffered by the books in the library is owing to acid vapours evolved by the combustion of the gas, it is advisable, for the preservation of the library, either that the gas should be discontinued or that some arrangement should be adopted for carrying off the fumes by an improved system of ventilation." Professor Faraday suggested the latter, which was adopted.

Continuing, the Equitable and the London Gas Companies were launched to oppose companies already in the field—with fatal results, as for nearly twenty years they both failed to earn a dividend. The London Company, which was situated partly north and partly south of the Thames—in the Strand and Lambeth respectively—was destined to play an important part in the question of differential prices for gas in London. The Company was established in 1830, and incorporated by Act of Parliament in 1843. The mains were laid across the river; the works being at Vauxhall. Later a move was made to new works at Nine Elms. So happily were they placed that shortly after this their troubles ceased, and 10 per cent. was paid on the original shares. The Commercial Gas Company, for supplying the east of the Metropolis, was incorporated in 1847.

At this date, the "Gas-Works Clauses Act" was passed, for the

* Sir William Congreve's arrangement of "agreed areas."

purpose of consolidating in one Act "certain provisions usually contained in Acts authorizing the construction of gas-works for supplying towns with gas."

In 1848, a report was presented to the London authorities by Mr. Charles Pearson, and published in all the newspapers, wherein he demonstrated that the price of gas (then 6s.) ought to be governed by the cost of distribution, rather than by the cost of production.

On Dec. 3, 1849, the Directors of the newly-formed Great Central Gas Consumers' Company presented a lengthy petition signed by Thomas Dakin, setting forth the benefits of competition, and promising many privileges to the citizens—*i.e.*, (1) To supply the citizens with a brighter and purer gas; (2) A free meter and a free service, stamped and subject to inspection; (3) To supply the street lights with better gas at a lower rate; (4) The gas to be tested from time to time by eminent professors of chemistry under heavy pecuniary fines on the contractors.

The Directors adopted 9½ sperm candles as the standard of comparison for their gas, as recommended by Clegg; but the authorities fixed 12 wax candles in the Bill, which was higher than 9½ sperm candles. Printed documents distributed, said: "We will supply you with 9½ sperm candle gas as reported by Mr. Clegg, as a high average, at 4s. per 1000 cubic feet, which, if you will take 300 millions per annum will yield a dividend of 10 per cent. If you take 450 millions, we will supply at 3s. 6d., and if 600 millions you shall have it at 3s.; for we are advised that quantity has an important influence over price." It is worthy of note that under this Act of 1851 the supply of gas was voluntary on the part of the Company, though all legislation afterwards made it compulsory.

Competition was now universal, four or five companies supplying one district. On the south side of the river four companies were supplying Walworth Road, each having a main on both sides of the street—giving eight mains for one thoroughfare. This competition was disastrous; for the companies rarely paid anything like full dividends, and the provision of the 1847 Act was, when full dividends were paid (*viz.*, 10 per cent.), a reserve fund of one-tenth of the capital was to be accumulated. After that any further surplus was to go in reduction of price. The Act allowed companies to make up their dividend deficiencies of earlier years; and thus full dividends were practically assured by the Legislature. The price of gas was not reduced; nor was it likely to be under such conditions. During 1847 the price was about 6s. 6d. per 1000 cubic feet; and the South Metropolitan Company paid 6 per cent. Most of the other companies paid less—with the exception of the Imperial Company, who were in the happy position of paying 10 per cent.

With competition so very rife, and so many companies supplying one area, the consumers were the only ones who reaped any apparent benefit, and this often of an unscrupulous kind, by obtaining their gas for years without any payment whatever. When the supply was disconnected by one company for non-payment, a nominal deposit would induce a rival company to lay on a supply; and often three services were in the premises at one time. Dishonest consumers could thus take advantage of the secrecy observed by the rival companies to obtain their light free. Concessions of every kind were made to consumers to obtain their patronage, even to the extent of allowing one or more lights to be supplied free of charge. The company would alter fittings gratuitously; while gas would be sometimes supplied at one-third of the sale price. District inspectors had full powers and a free hand (including a commission) to get customers the best way they could—not new customers, it may here be mentioned, but "turn-overs" from the other companies. Ready cash changed hands in these transactions. A customer obtained, a meter would be left. A week or two later, another company would undertake to supply the customer by contract, with the addition of two or three free lights. Then as the mains of the three companies were side by side in the road, it was not an unusual occurrence to find that a company was drawing payment for gas taken from an opposition company's main. This was not the only source of loss to a company; for, in addition—in consequence of the hurried manner in which the mains were often laid, and continual changing of service-pipes—considerable escapes were always taking place, swelling the total of unaccounted-for gas. The difficulty was to bring to book the offending company, as the officers threw the responsibility upon their rivals; and in the event of a leakage being discovered on the mains of one company it was not unusual to attribute it to wilful damage on the part of a rival's workmen. In fact, the spirit of competition reached the point of personal animosity among the directors and officers of the various undertakings. Owing to the manner in which the pipes of these rival companies were hurriedly laid, explosions were the order of the day; and each company made the most of its rival's troubles.

In spite of all this ridicule and opposition, the Great Central Gas Company was formed by Mr. Charles Pearson, and Mr. Alexander Angus Croll, who afterwards became Sheriff. The Company started with the promise to supply gas at 4s. (and had a clause in their Act to this effect), to be reduced to 3s. 6d. and 3s. per 1000 cubic feet as soon as the consumption would enable the Company to make the reduction out of the "excess of profits after paying their shareholders a dividend of 10 per cent." Needless to say, the Company never got below 4s. The Great Central Company also agreed to have inserted in the Act a clause giving free meters and service-pipes to consumers. They had power to pay deficiency in dividends of previous years that were below 10 per cent.; and they were not compelled to form a reserve fund. The Act had a clause in it stating that the Company should not supply gas to any lamp or burner in any street, church, chapel, &c., in the east of London, except in the districts of the British Gaslight Company, the Ratcliffe Company, and the Commercial Gas Company, and then only on payment to such companies of 40s. for every lamp or burner supplied. A similar penalty applied to certain parishes which were in the districts of the Gaslight and Coke Company and the City of London Company—penalties being recoverable.

Thus the period of supply between the time of the passing of the Gas-Works Clauses Act of 1847, and the coming into force of the Metropolis Gas Act of 1860, was one of unrestricted competition. In 1848, the price of gas was 6s. per 1000 cubic feet all over the Metropolis. The "cheap gas" agitation then spread to the south of the Thames; and Mr. John Thwaites, a draper in the Borough, who afterwards became Sir John Thwaites, the originator, and first Chairman of the Metropolitan Board of Works, was the prime mover. Sir George Livesey (then a lad, at the Old Kent Road works, under his father), speaking of these times, says: "1848 was my advent into the gas industry; and I remember quite well, as a youngster, attending a public meeting, and hearing Mr. John Thwaites speak. They demanded a reduction from 6s. to 4s. If the companies had been reasonable and reduced it by 1s., to 5s., I think it would have stopped the agitation; but the companies were obstinate, and persisted in the 6s. price."

The result of the agitation was the immediate starting in South London of the Surrey Consumers' Company, also by Mr. Thwaites and Mr. Croll. This Company likewise started with the promise to supply at 4s. per 1000 cubic feet. These two "Consumers' Companies," born of an agitation of aggrieved ratepayers and gas consumers, speedily brought down the price of London gas from 6s. to 4s. The South Metropolitan Company had been previously paying 6 per cent. They had to reduce this to 5 per cent.; and other companies had to do the same. On the passing of the 1860 Act, very few of the thirteen companies now in the Metropolis paid more than 6 per cent., which was looked upon as a good dividend.

In the City, previous to the advent of the Great Central Company, the districts of supply were partitioned out between the City of London Company and the Chartered Company, who alone supplied public and private lighting. The boundary of these two Companies was well defined, no attempt at infringement of it was made, and competition between them was unknown. Other companies were carefully prevented from laying down pipes. But though there was no competition, it was unrestricted outside, which enabled the authorities to submit these facts to the two Companies from time to time, and required what appeared to be a commensurate reduction in the price both in public and private lighting supply. The result was that between 1823 and 1860 the price was reduced by the two Companies from 15s. to 4s., as set out below:—

	City of London Company.	Chartered Company.		City of London Company.	Chartered Company.
	s. d.	s. d.		s. d.	s. d.
1823 .	15 0	15 0	1839 .	9 0	9 0
1824 .	15 0	15 0	1840 .	9 0	9 0
1825 .	15 0	15 0	1841 .	9 0	9 0
1826 .	15 0	15 0	1842 .	9 0	9 0
1827 .	15 0	15 0	1843 .	8 0	8 0
1828 .	13 6	13 6	1844 .	8s. and 7s.	8s. and 7s.
1829 .	13 6	13 6	1845 .	7 0	7 0
1830 .	13 6	13 6	1846 .	7 0	7 0
1831 .	12 6	12 6	1847 .	7s. and 6s.	7s. and 6s.
1832 .	12 6	12 6	1848 .	6 0	6 0
1833 .	10 0	11 3	1849 .	5s. and 4s.	5s. and 4s.
1834 .	10 0	10 0	1850 to 1860	4 0	4s. Competition by Great Central Consumers' Co.
1835 .	10 0	10 0			
1836 .	10s. and 9s.	10s. and 9s.			
1837 .	9 0	9 0			
1838 .	9 0	9 0			

In the year 1850, the contracts for lighting the public lamps having been advertised, the result was the letting to the new company of the public lighting, at a reduced rate. But the public had to submit to the inconvenience of having 1650 holes opened in the paving. In 1852, tenders for lighting were again received. The Chartered Company obtained the portion originally lighted by them, the Great Central Company retaining the remainder; and a further sum was thus saved. Owing to this reletting of a portion of the area to the Chartered Company, and the reconnection of their supply-pipes, and the disconnection of the Consumers' Company's pipes, 1093 holes were opened in the roads. Thus though a considerable saving had been effected, the public suffered by the inevitable opening of the public streets, apart from the fact that the repair of the pavements, and the alteration in the piping, had to be a first charge on the Companies and affected the price of gas.

The price now stood at 4s., until the Companies were districted, which came about in this way: Mr. Thwaites, the originator of the Consumers' Gas Companies, was likewise the originator of the districting. The Surrey Consumers' Company, like the Great Central Consumers' Company, before they commenced, had no end of promises from would-be consumers. As soon as they were ready to start, the other companies reduced their price to 4s.,

and took off meter-rents. Then the customers who had promised to take their gas failed to keep their word. The Surrey Consumers' Company were in a great difficulty. Mr. Thwaites said, "I see competition is a failure." The Companies struggled on for a year or two; and then in 1853, at Mr. Thwaites' suggestion, they agreed to divide South London between them. In 1854, the South London Companies having divided that portion of the Metropolis between them, went to Parliament for sanction for this districting; but, to use Sir George Livesey's words, "the feeling against this monopoly was so strong that Parliament refused its sanction," and so they went on under the agreement until 1860, when sanction was obtained.

(To be continued.)

REPORTS OF THE COMMISSIONS APPOINTED BY THE GERMAN GAS ASSOCIATION.

TRAINING COMMISSION.

The report of the Training Commission mentions that the courses of instruction for gas makers and fitters, held at Cologne during the past year in connection with the Associated Royal Schools of Machine Design, have proved successful, and have been attended by 24 students. In Bremen, 71 students took part in the last course. Arrangements are now in progress for the institution of similar classes in Nuremberg, Munich, and Berlin. At Altenburg, 10 students have notified their desire to attend the next classes. The peculiar educational conditions of Altenburg do not render it desirable that the instruction should be given in connection with a lower-grade trade school, in the manner which is recommended in the set of resolutions recently passed by the Commission and recorded below. The school at Dessau has just celebrated its tenth anniversary, and has been attended by 16 students. The results have been partially successful; but it has been found that some alteration is called for in the regulations for the admission of pupils to the classes in gas making. Hitherto a new student must have been 24 years old, must have received a good elementary education, and must have been apprenticed for three years to a master tradesman. The last requirement has proved insufficient in some cases; students having presented themselves who have not been taught well enough to derive full benefit from the classes. On the other hand, pupils of superior education have joined the classes whose only idea has been to use the Dessau diploma in procuring posts as gas engineers in small works. As this is precisely what the Commission has desired to prevent, it has been decided to copy the regulation in force at Cologne, and, as far as possible, only to accept such pupils as have already been engaged on gas-works as qualified furnace builders or smiths, or have been employed as fitters in building or remodelling factories; the whole object of the instruction being to produce leading hands and foremen (not managers for small gas-works) of whom the German industry is so badly in need.

In consequence of the experience already gained, therefore, the Training Commission of the Association came to the following decisions at their last meeting: (1) To reduce to the utmost the amount of theoretical instruction given in the gas makers' and similar classes. (2) To require evidence from each new pupil of his having been practically engaged in a gas-works in connection with the manufacture; and to give preference to such persons as have been employed as furnace builders or working engineers. (3) To hold the classes for gas makers and gas-fitters, when possible, in connection with some lower-grade trade school or similar establishment, such as a building or manual-labour school, or a lower-grade machinery school. (4) To make special endeavours to attract furnace builders and working fitters to the classes, and to give them the best training possible.

At the same meeting of the Commission, Dr. Bunte presented a report upon the eighth course of instruction which he had recently brought to a conclusion at Karlsruhe; and he expressed a desire that the instruction offered to water engineers should be enlarged by the addition of bacteriology—a suggestion that has since been adopted. The courses were held during a fortnight of last March—29 students attending them. The chief part of the teaching consisted in eleven lectures on gas chemistry delivered by Dr. Bunte, which covered the theory and practice of gas manufacture, purification, and the use and employment of bye-products. The lectures lasted an hour-and-a-half each, and were followed by a course of seven other lectures delivered by Professor Eitner, dealing with the more important methods of examining the different substances used in the manufacture of gas. Dr. Eitner's syllabus covered the analysis and calorimetric investigation of coal, the examination of gas, the analysis of tar, liquor, purifying material, and cyanogen sludge, methods for the examination and purification of water, with a special reference to boiler-feed water, the theory and practice of photometry, the measurement of illuminating power at different angles, the determination of illumination, and the use of the Junkers, Le Chatelier, and Wanner pyrometers.

The afternoons of the first six days during which the course lasted were devoted to practical work in the laboratory of the Institute, under the leadership of the assistants engaged there; the subjects dealt with being those that had been mentioned in the lectures delivered in the morning. On two days also demonstrations were given by Professor Klein of methods employed in the bacteriological investigation of water. Two other afternoons were devoted to visiting the gas-works at Pforzheim, where there is a Dellwik water-gas plant, and at Heidelberg, where the water-gas plant is of Humphreys and Glasgow's system. The remaining days were spent in the experimental laboratory of the Association, and in the gas-works at Karlsruhe; the students being shown how to manage retort-furnaces, to analyze the generator and furnace gases, and calculate the excess of air in the latter; to supervise the scrubbers and purifiers, and to estimate the ammonia, cyanogen, sulphuretted hydrogen, and oxygen in the gas; to analyze the bye-products, determining the sulphur and blue in spent purifying material, and the amount of ammonia in the liquor, and in the waste liquid from the stills; and to superintend the water-gas plant. Dr. Bunte also exhibited to the Heating Commission the syllabus of instruction given to illuminating engineers at the Technological High School in Karlsruhe (which is quoted in full in the report).

The report itself is brought to a conclusion by an expression of the hope that classes covering the whole of the gas industry will soon be instituted in Nuremberg, Munich, Berlin, and Breslau, for the Commission feels very strongly that the instruction so given to the minor officials engaged in the manufacture, distribution, and utilization of gas must prove of great benefit to the industry in general, and to the public who consume gas in Germany.

WATER STATISTICS COMMISSION.

The report of the Water Statistics Commission mentions that the usual inquiry circular was sent out for the eighteenth time last year—472 works being applied to, of which it is expected that some 360 will reply. The questions have been amplified by a request for information as to the calorific value of the fuel burnt under the boilers; for its quality varies so largely in different places that the data already calculated to show the amount of work done per unit of fuel consumed are hardly comparable without correction. During the past year a member of the Association made the suggestion that statistics should be compiled to show the number of pipes that have burst; but although the proposal was discussed at a recent meeting, no agreement has been reached by the Commission. It was felt that statistics on the subject of fractures would be very useful; but the results might be improperly used in trade rivalry between cast and wrought iron. Pipes break from a variety of causes. Perhaps the nature of the soil in which they lie has most to do with their failure; but experience also shows that fractures occur more frequently now that towns are piped in every street than they did before. Hence the Commission have felt it preferable to prepare a special sheet of questions relating to pipe failures, and to send it to all the gas-works belonging to the Association, as well as to the water-works, in order that the largest possible quantity of material may be available for study.

WATER-WORKS COMMISSION.

The report of the Commission appointed to study the management of water-works (signed by Herr L. Wellmann, the President) is quite short. In accordance with instructions received from the Association at last year's meeting, a circular has been issued asking for information as to the success or failure of experiments for the discovery of water by means of the divining-rod. A large amount of material has already been collected; but it has been thought better to await the arrival of more before dealing with the subject exhaustively.

A circular has also been sent out to the water-works that hand their annual returns to the Statistics Commission, with the object of ascertaining whether the "Rules for the Erection and Operation of Water-Works" drawn up some time ago by the Imperial Institute of Hygiene have proved satisfactory. The general trend of the answers received is to the effect that the rules are technically and practically good; but further experience is required before a final opinion on the subject can be passed.

MUSEUM COMMISSION.

The last report contained in the pamphlet issued by the German Gas Association for distribution at the Mannheim meeting is that of the Commission appointed at Bremen last year to superintend the due representation of the gas industry at the German Museum provisionally installed in the old National Museum and in a military barracks at Munich. The Commissiou was composed of the President of the Association and Herren Grahn (since deceased), Reese, Söhren, Ries, and Schilling; the latter of whom has already given an account of the exhibits so far received.* As our previous article appears to cover all the ground, it is scarcely necessary to say more on the subject, except to add that the report ends with a classified list of articles which are already, or which it is hoped will soon be, placed by members of the gas and water industries in Germany, on view in the temporary premises at Munich.

* See "JOURNAL," Vol. XCVII., p. 339.

The Yorkshire Junior Gas Association will next Saturday visit Ripon, on their second annual excursiou. Under the guidance of Mr. W. T. Lancaster, the Engineer and Manager, the gas-works will be inspected; and the day's programme also includes visits to Ripon Cathedral, Fountains Abbey, &c.

HIGH PRESSURE DISTRIBUTION IN AMERICA.

[Communicated.]

Less than five years ago, in the southern part of the State of New Jersey, there were a number of small gas-works, which eked out a precarious living for the stockholders and gave to several families of workers what Americans call a "cinch." Perhaps one only out of the eight or nine works was run on anything like practical lines—namely, Trenton; and the rest, as indicated above, provided high wages and low labour effort to a number of men. Contrast the state of things then with what obtains now; and it will be seen how, when the effort was needed, men stepped forth of the calibre that has made for America a name that spells initiative energy and success.

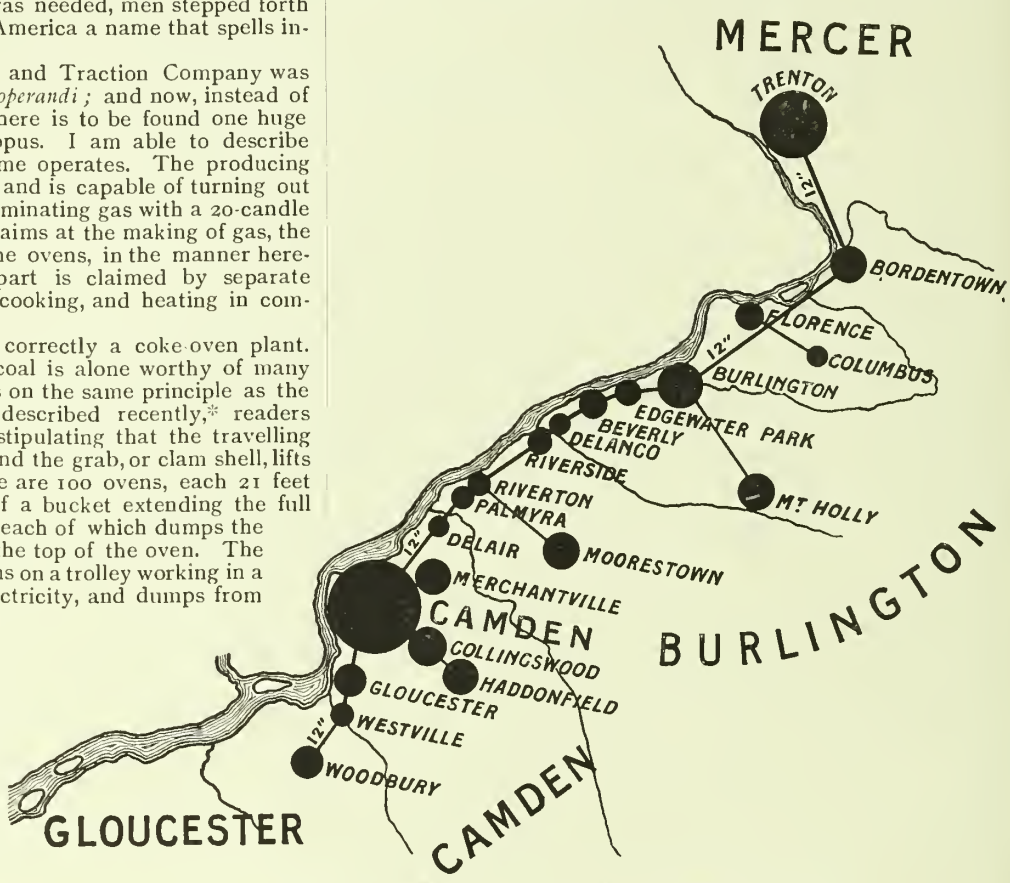
The South Jersey Gas, Electric, and Traction Company was formed to revolutionize the *modus operandi;* and now, instead of a lot of small independent uuits, there is to be found one huge works with tentacles like an octopus. I am able to describe the unique way in which the scheme operates. The producing plant is located at Camden (N.J.), and is capable of turning out per day 10 million cubic feet of illuminating gas with a 20-candle power value. The plant primarily aims at the making of gas, the bulk of which is used for heating the ovens, in the manner hereafter described; but the chief part is claimed by separate holders, and is used for lighting, cooking, and heating in commercial and domestic districts.

The carbonizing plant is more correctly a coke-oven plant. The machinery for handling the coal is alone worthy of many pages of description; but as it acts on the same principle as the Mariendorf plant illustrated and described recently,* readers can easily fill in the details—only stipulating that the travelling buckets each holds 5 tons of coal, and the grab, or clam shell, lifts that quantity every minute. There are 100 ovens, each 21 feet long. These are filled by means of a bucket extending the full width, and fitted with five outlets, each of which dumps the coal into a separate feed shoot on the top of the oven. The bucket, or bottom dump hopper, runs on a trolley working in a 16-inch I beam, is traversed by electricity, and dumps from five places simultaneously by actuating one lever.

For working purposes the 100 ovens are divided into four units of 25 ovens each, and each unit is charged once every twenty-four hours, during which time, by means of separate valves and mains, it works eight hours, giving good coal gas equal to 20 candles. It is then bye-passed through a separate main to a small holder of 25,000 cubic feet capacity, which has an outlet to supply the ovens with heating gas—in fact, is used only for that purpose. In practice, one unit is always working on the small reservoir holder, so as to provide heating gas; while the other three are making illuminating gas. By experience it is known when the oven should be cut out from the mains, so that the process of making coke can be continued. In this way the carbon is in a form entirely free from sulphur, tar, and gas; and therefore it is specially suitable for burning in slow-combustion stoves.

A feature of interest locally, during the early days of the plant, was how to dispose of the huge quantity of coke made. In the first year it had to be stacked on spare land, covering 5 acres, to a height of 18 feet, and inability to dispose of the coke made the promoters incline to the belief that commercial success would not attend the plant. However, men like these were not to be baulked. They put down crushing plant and made coke of a size suitable for stoves, and then set to work to advertise it. In less than one summer, the huge pile was reduced to a few tons; and from that time onward it has never been given a chance to accumulate. Railroad tracks have been laid in, and the cars are loaded and drawn out in a continuous stream. Gas was aimed at first. This was followed by coke when the demand grew; and now there is a complete plant for extracting the benzol, after which the tar and pitch, &c., are sold to the refiners.

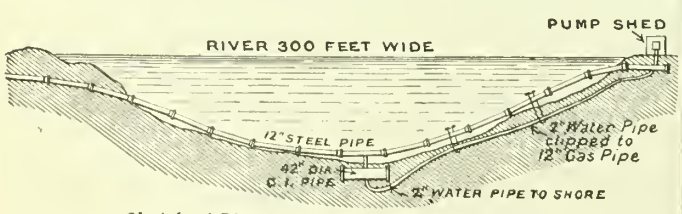
The chief point of interest to English engineers is the method of distribution. On the old system, with separate works, the gas was sent out at ordinary holder pressure; but when catering for the small towns with the main supply from new works a totally different scheme was evolved. The length of ground to be covered is at present 58 miles; but soon the supply pipe or feeder will be extended to Patterson (N.J.); thus making it a total length of 200 miles. On this proposition the Americans had the full benefit of the experience gained by the pioneers of the oil pipe-line layers, and took advantage of it. The details were as follows: It was arranged that the gas should be sent out from the Camden works by means of compressors, working into tanks which gave a pressure, throughout the main feeder, of 40 lbs. per square inch. We publish a map of the system, from which it will be seen that there is a 12-inch main, which is of steel construction and runs from Camden, north to Trenton and south as far as Woodbury. The pipe runs through a number of small towns; but the main pipe simply acts as a carrier, as the gas is run into the existing holders of the old small works, and thence sent out at 4 inches pressure to the consumers. Each holder is worked automatically; a lever being arranged along the side in a similar way to a hydraulic pressure tank, so that when the holder reaches a certain level, catches lift or lower a valve to thus keep a constant maximum and minimum quantity in the holders. The pressure of 40 lbs. is reduced by a regulating governor at the entrance to the holders.



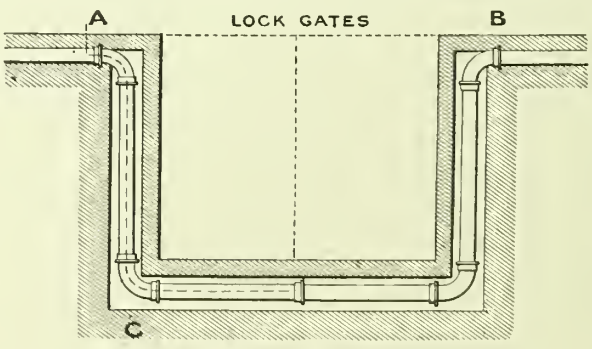
Map of the South Jersey Gas, Electric, and Traction Company's District.

To afford some idea of what can be done with gas supplied through a steel main under pressure, we give one or two particular instances; the first being Mount Holly, which had a population of about 8000 people and is about 8 miles from the main pipe. The consumption of 90,000 cubic feet per day is sent through a 1½-inch diameter pipe, at a pressure of 40 lbs. per square inch. Moorestown, 6 miles from the trunk line, used 30,000 cubic feet per day; and this was sent through a 1-inch diameter pipe. Both of these places had a relief holder; but in the case of Columbus, with an output of 50,000 cubic feet passed through a 1½-inch diameter pipe, there was not this convenience for reducing the pressure in bulk. A separate governor was therefore put in to the inlet of the town supply pipe, which was 5 miles long and composed of 6-inch, 5-inch, and 3-inch pipe. The town of Delair had 3 miles of 1-inch pipe. A remarkable thing in this town is that, with 120 houses, every one had the gas laid on; and

* See "Journal," Vol. XCVIII., p. 220.



Sketch of River, Pipes, Sleeves, and Drip-Box.



A. One-inch drip-pipe shown by dotted lines. B. Two 12-inch diameter steel gas-mains—one high-pressure; the other low-pressure. C. Tunnel four feet below water.

Crossing 50 Feet Wide Creek at Camden.

as the town pipe was carrying full pressure, each house had a separate governor. In a similar way, farmers all along the line were canvassed, and, without much urging, put in a supply, which was also, of course, separately governed to reduce pressure.

Reference has been made to the following of oil-pipe layers in the methods here adopted; and when it is said that the 58 miles of 12-inch main were laid in 58 days, it may be inferred that there was some hustling going on—in fact, the Superintendent, Mr. Andrew Manthorne, practically lived in an automobile so as to get about over the line quickly. His plan was to start two gangs of men at adjacent towns, working south and north till they met approximately midway. Each gang consisted of six men, with a team of horses with a plough, which cut up the hard surface. Following this were a ditching plough and diggers. Where the surface of the road was very hard, a traction-engine was used to cut it with the aid of a steel plough.

Great difficulties were encountered, but were all overcome. Some of the tasks tackled by Mr. Manthorne may be named. At one part of the line a river 300 feet wide had to be crossed. Two scows, or shallow barges, were hired and placed in position on the water, set 4 feet apart; and the space between them planked over so as to make a working platform on which the pipe from the shore rested. A new length of pipe was then sighted by the "stabber," who took his line of the pipe from behind the "jack" on which the already secured pipe rested. The main "jack" (in the form of a tripod, with one vertical leg and one inclined, and fitted with rests) held the end of the loose pipe; and when the sight was taken, the helpers on each side of the pipe applied the tongs and started the thread in action. When this length was fixed, the tug slowly pulled the scows away from the bank until the end of the pipe was in position for taking the next length. By working in this manner, the 12-inch pipe was screwed together laid along the bed of the river, 24 feet deep by 300 feet wide. The time taken was 2 hours 40 minutes—truly a remarkable achievement, but authenticated. For keeping the gas-pipe in position, sinkers were used. These consisted of castings made in halves, tightly bolted together and designed to clip the pipe; one being placed at every coupling. Each of the sinkers weighed 1100 lbs., was made in the form of a sleeve, and fitted round the coupling. Thus all strain was taken off the pipe coupling.

Not the less wonderful was the placing of a drip for this pipe right in the middle of the span across the river. The drip consisted of a 42-inch diameter cast-iron flanged pipe or cylinder about 10 feet long, laid under the 12-inch gas-pipe and connected thereto by means of a 3-inch pipe, which allowed all liquids that condensed or gathered in the gas-pipe to fall into the cast-iron cylinder below. To the underside of this, again, there was attached a 2-inch screwed pipe, which, by means of an elbow, made the water drain pipe take the same curve as the 12-inch gas-pipe; clips being bolted to the latter and made to carry the 2-inch pipe. This drip was fixed and laid after the gas-pipe was in position; and the indefatigable Superintendent was, on this occasion at least, forced to quit his inspecting automobile to don the diver's dress, for the purpose of going over the joints to see that a sound job had been made. That this desired end was gained is proved by the fact that in two years the drip yielded not more than six barrels of water. For sinking the drip-pipe a total weight of 2 tons was used in the form of rails laid on each side of the pipe, on top of the flange of the clips, and above the rails pig iron was placed to keep the whole securely in place.

In Camden, a small creek 50 feet wide had to be crossed. Permission could not be obtained to cross this except under the abutments of a drawbridge belonging to the lock gates. The pipe at this point was also 12 inches diameter; and the authorities insisted that it be sunk 4 feet below the river bed. This was accomplished by divers; and, in addition to the high-pressure line, it was necessary to lay alongside a second 12-inch pipe, which was needed for supplying gas, under ordinary holder pressure, to the community in its vicinity. A tunnel was built; and after the pipes had been screwed together on the bank, they were hauled through this tunnel by manual labour. The dips in this case were differently constructed; the water-pipe being fixed inside each 12-inch gas-pipe, and carried thus to the bank, where proper connections were made to bring the 1-inch water-pipes through the gas-pipe, so that they could be pumped.

It would be thought that natural difficulties abounded on a job of this magnitude—sufficient to tax the resources of any man; but over and above these the art of man invented others, which, if not equal to those naturally found, were more aggravatingly tiresome. On another creek, where a branch pipe line crossed, the neighbourhood sheltered some evilly disposed persons who had a natural, or unnatural, grudge against the Gas Company. This was manifested in a marked and unpleasant degree in the following manner: After the pipe was laid, these schemers took advantage of a dark night and put into use a petrol launch, which they brought into position approximately above the pipe, and then dropped a drag anchor. Full speed ahead was signalled; and after a little trouble (so it is assumed) the pipe was torn in two. The damage was traced by known means, and the pipe was repaired, only to be subsequently broken by a similar contrivance. On this occasion, however, Mr. Manthorne discovered the villainy. The repairs were effected, and the pipe built in a tunnel underneath the river bed; so that the old trick, if tried again, would prove abortive.

As an item of interest, one may tell how, in a usual American manner, the pioneers of this scheme of gas making and distribution went ahead even quicker than their scheme. In other words, the Superintendent had his pipe-line laid and all ready for work long before the contractors for the coke-gas ovens were ready to supply the illuminating agent. The old works at Trenton were kept in good shape ready to supply gas in case difficulty was met with on the new plant; so he made gas in his old benches and on the water-gas sets, and ran connections to the high-pressure line. Such a thing had not been contemplated in designing the scheme of work. There were therefore no pumps or compressors to force the gas through. Nothing daunted, the Superintendent decided to try what an ordinary exhauster would do; and he coupled up the one generally in use at the gas-works. By dint of circumstances, once he had this started, in a sort of inquisitive quasi-experimental way, he had to keep the thing going for many months. But he only had a No. 6 Roots' blower for his compressor; and this was driven by the usual engine which is calculated to give about 6 H.P. under ordinary pressure and speed. In consequence, the plant had to run at tremendous speed; and in a very short time the small connecting pipes between the blower and the mains were almost red hot.

The plant described above has now been considerably enlarged, and there is no doubt the scheme, if somewhat unusual, may be regarded as a great success.

UNACCOUNTED-FOR GAS AND THE CONSUMERS' METERS.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The Sales of Gas Act, 1859, is approaching its Year of Jubilee, notwithstanding the fact that it was pronounced to be unsatisfactory at the time of its inception. Apart from its other defects, sufficient attention does not appear to have been directed towards its relations with unaccounted-for gas, and to the serious loss which it entails upon gas companies. It is the object of the following remarks to show that this relation is more important than is generally supposed, and that there is good reason for believing that the consumer's meter is the largest factor of all that are concerned in the troublesome question of unaccounted-for gas. The practice of stating total loss as a percentage instead of as concrete figures is responsible for concealing and diverting attention from the enormous quantity of gas that is so disposed of. A loss of 10 per cent. in a one hundred million district may pass without attracting attention. But put it at 10 million cubic feet, and the very least will be an expression of wonder as to where on earth, or under the earth, it can all go to. Turning to the parliamentary returns for the years 1905 and 1906, we find the following figures:

	1905.	
Total gas made	168,647,676,000	cubic feet
,, ,, sold	155,579,725,000	,, ,,
	13,067,951,000	,, ,,
Allow 2 per cent. used on works, &c.	3,372,953,000	,, ,,
Difference	9,694,998,000	,, ,,

Equivalent to 5·75 per cent. of the total make.

	1906.	
Total gas made	174,904,791,000	cubic feet
,, ,, sold	161,407,725,000	,, ,,
	13,497,066,000	,, ,,
Allow 2 per cent.	3,498,095,000	,, ,,
Difference	9,998,971,000	,, ,,

Equivalent to 5·71 per cent. of the total make.

In the early days of gaslighting, the unaccounted-for item was accepted as a matter of course, and passed over without question, as being due to leakage or condensation. Later on, however, it became evident that the deficiency was a much larger quantity than could reasonably be supposed to escape and be diffused in the atmosphere without creating great inconvenience, not to say risk of danger; and various ways of accounting for it have been brought forward from time to time, as the common-sense conclusion is that the real loss by leakage can only be a small proportion of the quantity above named.

Among the points that have been fully investigated is the difference between the temperature at which the gas is registered at the station meter, and the average temperature at the consumer's meter, not overlooking the fact that some 30 per cent. of the total annual consumption is taken during the months of December and January, when the atmospheric temperature is at the lowest. A second is the loss on the public lighting due to more gas being really used than appears on the rental books. A third is that due to condensation of liquids; the probability being that the larger proportion of every gallon of water or oil pumped from the drip boxes, was measured at the station meter in the form of vapour. A fourth is the loss of gas when the mains or services are opened or disconnected for making up new connections, for repairs, or for clearing deposits of naphthalene. A fifth is the actual loss by leakage through flaws or cracks in the distributing pipes. A sixth is the gas used at the works and offices—as a rule not metered. The first could be disposed of by correcting

at the station meter—not to the stereotyped 60° Fahr., but to some monthly average, approximating as nearly as possible to the average ground temperature of the district. The second, fourth and fifth are directly subject to the control of the management. No. 6 can be ascertained by the use of meters; the 2 per cent. allowed for use on works is sufficient to include the loss under No. 4; while No. 2 need not, and should not, be an appreciable quantity. Factors Nos. 1, 3, and 5, together with No. 7, the loss by the meters, are therefore chiefly concerned in making up the annual loss of about 10,000 million cubic feet.

The problem is complicated by the fact that many of the items just enumerated do not admit of accurate measurement. Nos. 1 and 3 can be defined to some extent by the aid of available statistics or by direct experiments. As regards Nos. 2, 4, 5, and 6, we may claim that, in the average gas undertaking, no negligence in respect to them is allowed, but that the staff are kept fully alive to the importance of locating and repairing any source of leakage. We must also remember that the average supply pressure over the whole district, and at the inlet of the meters, has practically doubled within the last thirty years; and another source of loss that acquires increased importance year by year, with the continual growth of modern civilization and refinement, is that due to injury or interference with the distributing pipes, inflicted by other parties making use of the subsoil. When there was only the gas-main on one side of the road, the water-main on the other, and the sewer in the middle, each agent had a territory to itself, and enjoyed immunity from outside interference. But now we find all the chief thoroughfares in our large cities used for anything between twelve and twenty distinct lines or conduits; and this happy condition no longer applies.

Although so much has been written and said about unaccounted-for gas, but little allusion has been made to the portion with which the meter is concerned; and the question has never been specially investigated. We may divide the subject into illegal losses, for which the company have a remedy at law, and legal losses, for which they have no remedy. The purchaser usually claims to be entitled to "the turn of the scale;" but it is understood that the turn is a mere trifle—possibly a fraction of 1 per cent. No one would claim a turn of ¼ or ½ oz. to 1 lb.; yet I venture to think that gas companies have to give even a larger proportion, and that the limits of legal error are very much more than a trifling quantity. The illegal losses refer to actual dishonesty, either by the direct process of making a bye-pass connection round the meter, thus obtaining gas that does not go through the meter at all, or by the indirect, and in a legal sense safer, means of retaining a slow meter in use, and leaving the gas company to find it out as best they can. Dry meters are now generally used; and we know they are apt in course of time to pass unregistered gas by reason of leakage at the valves. We know also that prevailing ideas, even among respectable consumers, are very loose.

Gas companies are occasionally held up to the public as not without some dealings in ways that are dark; but any experienced inspector could show up the other side of the shield by means of examples that come to his notice every quarter, of customers whose bills have gradually fallen to one-half or less, but who consider themselves justified in accepting the obviously low and incorrect account so long as the gas company raise no objection, if they do not deliberately fence with and evade any direct inquiry. He could tell how extremely rare—so rare as to excite comment in the office—it is for an account to be returned as not being sufficient. Very often attention is directed to the fact that a customer who habitually appears on the late list at the end of the quarter, makes an exception by paying up promptly. Under modern conditions accounts are apt to fluctuate from year to year, and it is more difficult for the gas companies to check the accuracy of accounts by comparisons with previous years. In the old times, the consumption was fairly regular from year to year; and therefore calling over the accounts with the corresponding quarter of the previous year was a useful check against slow or leaky meters. But now there are all sorts of variations. People substitute incandescent burners for flat-flames, or perhaps try some other agent for lighting, or adopt cookers, gas-fires, technical appliances, &c.; and the last two named are used according to the prevailing temperature or to the condition of trade. Possibly the strain thrown on the meter by suddenly turning on or turning off large burners is no assistance towards maintaining the soundness of the valves; and it is now very much more difficult to detect slow meters.

Very often the circumstances are such that the consumer himself cannot judge how far his account may be correct, or how much of a reduction in the bill may be due (say) to the adoption of electricity for a portion of the lighting, or to slowing-down of the meter. Then the introduction of slot meters tends to increase the loss in two ways. By diminishing the average consumption per meter, it tends to increase the chances of error. The average consumption per ordinary meter is in the neighbourhood of 40,000 cubic feet per annum; but that of the slot meter is less than half—say, about 15,000 feet. This means 66 meters per million cubic feet sold per annum, instead of 25. There is also a new feature introduced in the shape of the shut-off valve. Of course, leakage by this means would be shown on the working index; but it is exceedingly difficult, and in some cases impossible, to recover anything extra or in addition to the coins that are put in the slot. The writer, like many others, anticipated that the effect of the introduction of slot meters would be an appreciable increase in the unaccounted-for item. But it is only fair to the makers of slot meters to add that this expectation has not been realized in practice; and this fact is a high compliment to the accuracy of their machinery. The slot-meter consumer is under closer supervision than the ordinary; and the conditions of his consumption are within the personal ken of the officers of the company to an extent that does not attain in ordinary meters. Yet the general experience is that there are far less cases of "slows" in the slot than in the ordinary meter department.

We must accept a certain amount of loss due to intentional dishonesty, or to *bonâ fide* oversight, as being unavoidable in the ordinary course of things. But the next question is the amount of loss that may come within the limits of legal error, or, in other words, the "turn of the scale." The Sales of Gas Act provides certain securities towards the accurate registration of meters; but its regulations never were sufficient or satisfactory, and tend to become less so every year. They show the behaviour of the instrument under certain limited conditions that rarely obtain in practice, and do not fairly indicate the average working condition. No meter is worked under constant conditions as to pressure or as to quantity passed, but under a range of pressures extending at times over several inches of water, and from any quantity commencing at the point where the meter begins to register up to the maximum that will pass through it. It may therefore be questioned whether a single test at one fixed pressure gives more than an indirect indication of the action under changing conditions of pressure and consumption, and the rapid variations due to the turning on or off of large burners.

The tests that are applied to the millions of meters in actual use are comprised in the following few words (see Sales of Gas Act, 1859, Section XIII.):—

> Firstly the meter should be tested for soundness or leakage only, not for percentage of error, when fixed on a horizontal base, and with gas under a pressure equal to a column of water 3 inches high with a light or lights consuming not more than one-twentieth part of its measuring capacity per hour marked thereon, nor less than half a cubic foot per hour for all meters of a measuring capacity not exceeding 100 cubic feet per hour, and not more than one-fortieth part for meters of greater measuring capacity. All meters found to work under such test should be deemed sound meters; and any meter found not to work under such test should not be stamped.
>
> The meter to be tested for percentage of error should be fixed on a horizontal base, and should be tested at a pressure equal to a column of water five-tenths of an inch high and passing the quantity which should be marked thereon as its measuring capacity per hour; and the water used in such testing, and the air of the room in which such testing should be made, should be as nearly as practicable of the same temperature as the gas or air passed through the meter.

Section XII. fixes the limit of error at 2 per cent. in favour of the seller, or 3 per cent. against him.

These clauses represent the conditions defining a legally correct meter, and especially when we remember that meters in the neighbourhood of the gas-works or in situations of high altitude may be worked under an inlet pressure of 6 inches or more, it is obvious that a legally correct meter may be far from being an actual just measure.

As an illustration, take a size that is most generally used—say, a 10-light meter having a nominal or marked capacity of 60 cubic feet per hour. The meter can be tested for soundness while passing 3 cubic feet per hour. The instrument would pass the soundness test if it only indicated one-third of this quantity, and passed the remainder unregistered. So it is passed for the second test, and may be assumed to really register accurately. But the 2 cubic feet lost or passed unregistered at 30-10ths would become less than one cubic foot at 5-10ths, and would therefore figure as a small percentage error—too small to lead to the rejection of the meter. But the effect of a loss in the form of unregistered gas under the soundness test is far more important, in fairness to the seller, than a percentage slow under the second test—in fact, a gas company would act wisely in preferring a sound meter 5 per cent. slow to the above. In the case of a slow meter, the actual loss can be readily defined. But with a meter passing unregistered gas, the loss is a constant first charge so long as the meter is in use and passing sufficient gas to cover or exceed the defect. It is by no means unreasonable to suppose that the meter above instanced may be used to supply a number of incandescent bye-pass burners, and that the flash-lights are going for the whole of the time, day or night, that the burners are not in use. The annual consumption may be taken for the purpose of our argument at 50,000 cubic feet. A meter passing no unregistered gas, but 5 per cent. slow, would register 47,500 cubic feet, and the loss to the seller would be 2500 cubic feet; but the correct meter passing 2 cubic feet unregistered, would only indicate about 33,000 feet, and the loss would be 17,000 feet. If the meter was worked, as many meters are, at a point appreciably above 30-10ths pressure, the loss would be even greater. The common use of pilot or flash lights, and the usual practice of leaving the meter continually under pressure—the old-fashioned custom of turning the gas off at night becoming now untenable—have an important bearing in this connection.

The Sales of Gas Act does a great injustice to the seller in not attaching sufficient importance to the difference between passing gas unregistered, and registering slow, as illustrated in the above example. The conditions may have been as stringent as was practicable with meters as made in 1860; but modern-made meters would pass much more rigorous tests, and there is also no reason why the margin allowed against the seller should not

be reduced. A fixed and reasonably low quantity should be substituted for "anything less than 5 per cent." allowed by the Act as unregistered gas, and the margin in favour of the buyer should be reduced to ½ or even to ¼ per cent. It is evident that, unless a large proportion of the meters in actual use would satisfactorily pass very much more rigorous tests than those prescribed by the Act, the quantity of gas above named as unaccounted for would be very substantially exceeded.

As a means of affording some indication of the actual working of the Act in practice, I will take the certificates obtained from the official inspectors over a period of six years, in a district comprising some 1600 dry meters. These include the whole of the meters disputed by the consumers, and also those which are objected to by the company; and it is remarkable that the ideas of the former in respect to presumably fast meters are rarely supported by the official tests, while the sellers' objections are usually sustained. A meter disputed by the consumer is as often correct as "fast;" and this fact shows the need for disseminating sound knowledge on the economical use of gas. Out of a total of 256 meters, 44 were returned as fast, 64 as correct, 8 as slow, 32 as correct and passing unregistered gas, 61 as slow and passing unregistered gas, and 47 as stopped, and therefore not admitting of any test. There is no evidence that the size of a meter has any connection with its accuracy; the various sizes being fairly well represented in all classes.

In respect to the six classes enumerated, the following remarks may be added:—

I.—44 fast meters. These range from 2·46 up to 9·39 per cent. fast, and only 9 exceed 5 per cent. The average over the whole is 4·25 per cent.

II.—64 correct meters. These, according to the terms of the Act, are within the limits of 2 per cent. fast and 3 per cent. slow. It may therefore be presumed that the average in this class would be 0·5 per cent. against the seller.

III.—8 slow meters. These exhibit a wider range than Class I., and extend up to 20 per cent., the average being about 10 per cent.

IV.—32 correct, but passing unregistered gas. With regard to the first part, the same remark applies as in the case of Class II. No further remark being made as to unregistered gas, it may be taken as a comparatively small quantity.

V.—61 slow and also passing unregistered gas. The results in this class are so interesting in connection with our subject that the remarks on each are reproduced in full. It will be seen that they range from 3·22 per cent. up to over 40 per cent. slow, and also that the gas passed unregistered, where stated, is a very appreciable quantity, usually running into two figures.

VI.—47 stopped meters. In some cases these stopped suddenly, but in the majority they gradually slowed down over two to six quarters. So that although an estimated charge was put in for the time over which they were supposed to be stopped, they represent a substantial loss to the seller.

Per Cent. Slow.	
3·22	not to register under 6 feet per hour.
3·29	,, ,, ,, ,,
3·85	,, ,, 12 ,, ,,
4·76	passing 9 feet per hour unregistered gas at 30-10ths pressure.
4·94	,, 12 ,, ,, ,, ,, ,, ,,
5·36	not to register under 6 feet per hour.
5·48	passing unregistered gas 18 feet per hour at 30-10ths pressure.
5·66	,, ,, ,, 12 ,, ,, ,, ,,
6·98	,, ,, ,, 5 ,, ,, ,, ,,
7·24	not to register under 14 feet per hour and leaks unregistered gas at index.
8·26	passing 6 feet per hour unregistered gas at 30-10ths pressure.
8·68	not to register under 16 feet per hour.
8·82	,, ,, 4 ,, ,,
9·09	,, ,, 24 ,, ,,
9·09	,, ,, 18 ,, ,,
9·09	,, ,, 18 ,, ,,
9·26	,, ,, 20 ,, ,, leaks at index.
9·67	noisy in working.
10·39	not to register under 12 feet per hour.
10·45	,, ,, 9 ,, ,,
11·11	passing unregistered gas 5 feet per hour at 30-10ths pressure.
11·50	not to register under 16 feet per hour.
11·50	passing 9 feet per hour unregistered gas at 30-10ths pressure.
11·89	,, ,, ,, ,, ,, ,, ,, ,,
12·13	,, 24 ,, ,, ,, ,, ,, ,,
12·28	,, ,, ,, ,, ,, ,, ,, ,,
12·59	will not register under 20 feet per hour.
12·66	passing unregistered gas 5 feet per hour at 30-10ths pressure.
13·04	,, ,, ,, 10 ,, ,, ,, ,,
13·04	,, ,, ,, ,, ,, ,, ,, ,,
13·42	,, ,, ,, 12 ,, ,, ,, ,,
14·38	,, ,, ,, 6 ,, ,, ,, ,,
15·97	not to register under 14 feet per hour.
16·67	,, ,, 22 ,, ,,
16·67	will not register under 22 feet per hour.
17·90	passing 20 feet per hour unregistered gas at 30-10ths.
18·03	,, 30 ,, ,, ,,
18·17	,, 15 ,, ,, ,,
19·14	will not register under 14 feet per hour.
20·00	,, ,, 14 ,,
20·63	passing 24 feet per hour unregistered gas at 30-10ths and leaks at index.
20·89	will not register under 36 feet per hour.
21·14	passing 24 feet per hour unregistered gas at 30-10ths.
22·48	,, 20 ,, ,, ,,
23·08	,, 17 ,, ,, ,,
24·01	,, 26 ,, ,, ,,
24·23	,, 7 ,, ,, ,,
26·04	,, 16 ,, ,, ,,
27·27	passing 12 feet per hour unregistered gas, Leaky at index.
28·70	,, 30 ,, ,, ,,
28·23	will not register under 42 feet per hour.
28·93	,, ,, 12 ,,
28·57	,, ,, 10 ,,
29·82	passing 8 feet per hour unregistered gas at 30-10ths.
33·70	will not register under 60 feet per hour.
33·68	,, ,, 18 ,,
36·86	lights defective. No passage at 5-10ths.
37·86	passing 70 feet per hour unregistered gas at 30-10ths.
43·18	,, 45 ,, ,, ,,
All	passes gas, but not to register.
All	,, ,, ,,

It will be seen that the loss to the consumer is a small quantity. Out of 256 meters tested, only 44 were against the consumer, and only 9 exceeded 5 per cent. It could not by any possibility exceed the figure stated, and might in practice be very much less. A meter 6 per cent. fast and passing 2 per cent. unregistered would in practice be very different from 4 per cent. fast, as shown in the foregoing example. This consideration applies to all the classes. But with the exception of class I. the remainder are all against the seller, and IV., V., and VI. are so to an indefinite extent. It will be noted that 140 (more than half the total) pass unregistered gas. These did not probably deviate from the paths of virtue by one decided step, but gradually got out of order—making a small beginning and going from bad to worse. But even if the important item of unregistered gas is rejected, the percentage of the "slows" is so much greater than than of the "fasts," as to warrant the claim that, instead of the pendulum receiving a definite swing in favour of the buyer by 1 per cent. difference on correct meters, the seller is entitled to have the advantage of the turn of the scale by reason of the inherent tendency of the meter to go against him.

I may be reminded that the sellers have their remedy in respect to slow meters. But I have purposely avoided this contention, as it is evidently unreasonable to add to the numerous responsibilities of gas suppliers the duty of recovering losses for slow registration. Nothing can be done in respect to the item of unregistered gas; and the "slows" are a very doubtful asset. In many, perhaps in the majority of cases, it is absolutely impossible to recover anything like a fair equivalent for them.

In conclusion, I venture to claim that the above statements, though admittedly indefinite and incomplete, are conclusive in respect to the need for an entire change in regard to the Sales of Gas Act, 1859, Clauses XII. and XIII., and that such a change is simply a matter of justice to the sellers of gas. I would suggest that the Committee of the Council of the Gas Institute who have this matter in hand should not fail to regard it from the point of view above suggested—its connection with unaccounted-for gas. The lines of amendment might take the form of striking off the percentage allowed in favour of the buyer; but the special point is that they should give much more attention to ascertaining the percentage of unregistered gas, and that it should be even more rigorously limited than the percentage of error.

A remarkable well exists near New Burlington (Ohio). It is fitted with two pumps—one furnishing fresh water, and the other water having such a high amount of mineral salts that it is almost brine. Two water-bearing beds confined between layers of limestone occur at this point, the upper carrying fresh and the lower salt water. The pipe of the fresh-water pump is only 16 feet long; that of the salt-water pump is 35 feet. The brine, being heavier than the fresh water, does not mix with it, but remains at the bottom of the well, and the longer pipe consequently draws only the salt water.

Referring to the increase in the price of gas in London, the "Engineer" last Friday said: "It was only to be expected that, the price of coal continuing to increase, gas companies should raise the price of gas. A number of circumstances has caused coal to be so expensive. There was a great outcry when the export tax of 1s. per ton was imposed; and great jubilation on the part of the coalowners greeted its repeal. But the price of coal did not go down. On the contrary, for various causes, it went up. In some cases it has risen by 2s. 6d. per ton. Everyone is suffering; and among the chief victims are the railways and the gas companies. With both of these the results are the same—dividends are less. But the railways cannot charge more for carrying people and goods—or, perhaps, we should say, do not do so—while the gas companies can increase the price of their illuminant. They do it, however, only under penalty; for if they raise the price of gas they must proportionately lower the amounts distributed in dividends. The actual ratio between the increase of price charged and the decrease in dividends—and *vice versâ*—is governed by statute, and it may be regarded as therefore to the advantage of the companies to keep the price as low as possible. Sir George Livesey, not only in the circular lately issued by the South Metropolitan Company, but also at the recent Engineering Conference, remarked upon this matter, and also upon the fact that gas companies are much more heavily rated now than was formerly the case."

THE TRUE SCOPE OF A GAS-WORKS.

As briefly mentioned in the "JOURNAL" last week (p. 20), Herr Kobbert, the Manager of the Gas-Works at Königsberg, read a paper before the Mannheim meeting of the German Gas Association, of which we now give a full abstract.

THE POSSIBLE DEMAND FOR GAS.

Herr Kobbert's main argument is that a gas-works of to-day by no means fulfils the functions it ought. In somewhat magniloquent language, a gas-works is usually termed a central station for the development of light and heat. To some extent it does behave as the general establishment where the artificial light required in a town is generated; but the works is very far from occupying a similar position in respect of artificial heat. Even where electricity is employed as the actual illuminating agent, the current ought really to be a product of the gas maker; for Herr Kobbert's ideal is that no coal should be burnt for any purpose whatever within the confines of a large town or its suburbs—the whole of the solid fuel required either to make gas or to evolve heat for every domestic and industrial purpose, including the generation of electricity, being carbonized or gasified in the perfect gas-works of the future.

To show how very greatly the quantity of gas consumed at the present day is below what it should be, the author quotes the conditions obtaining in a certain German town which in 1905 had 220,000 inhabitants. In this town the total make of gas for the year mentioned was roughly 500 million cubic feet, about 40 per cent.—*i.e.*, 200 millions—being used for boiling and cooking purposes. The town contained approximately 40,000 distinct houses and flats; 15 per cent. of the families occupying three rooms, 10 per cent. more than three rooms, and 75 per cent. less than three rooms. Now, as is well known a household of five persons living in three rooms should, on an average, consume about 53 feet of gas in the kitchen per day—a volume which, allowing for the summer season, wastefulness, &c., should amount to a consumption of 550 million feet per year for cooking only in a town of the size stated. Though the actual consumption for cooking was only 200 millions, the consumption for this purpose was, in comparison with other towns, very satisfactory. Hence the demand for cooking gas is capable of being more than doubled.

Similarly, it is well recognized that the consumption of gas in a flat of four rooms, without allowing for waste, is about 45,000 feet per year, which, at the price of 3s. 4d. per 1000 feet, is a little more than is commonly paid by German people living in such circumstances as their contribution towards the general expense of heating. If, now, it were possible to sell gas of 450 B.Th.U. per foot at a price of about 7d. or 10d. per 1000 feet in the manner to be suggested later on, the consumption would be increased in a town containing 40,000 separate occupied premises and 66,000 rooms altogether on the following scale: In 27,000 rooms of the occupied premises containing three or more rooms each, the consumption would be 300 million feet, which would represent an increased demand upon the gas-works of $1\frac{1}{2}$ million feet per day during 200 days of the year, and a maximum daily demand of $2\frac{3}{4}$ millions. Thus a town which at the present time is consuming 200 million feet of gas for cooking and room-warming purposes ought to consume $550 - 200 + 300 = 650$ millions—a figure which notably exceeds its ordinary consumption for every purpose at the present day.

In a town of the size under review each individual dwelling contains on an average 1·7 rooms, consuming about 3300 lbs. of fuel a year; hence, the consumption per four-roomed house should be about 7700 lbs. If the gas has a calorific value of about 560 B.Th.U. per cubic foot and the efficiency of the stoves is 80 per cent., while the calorific power of the coal used for heating purposes is 11,700 B.Th.U. per lb., the ratio of the heat developed by combustion to that rendered actually useful is about 4·4 to 1—that is to say, the efficiency of the ordinary solid fuel is only 18 per cent. Such a low efficiency in a town of the size considered represents a loss of about £50,000; the total consumption of solid fuel, including that burned by small tradesmen and in public schools and offices, &c., being altogether approximately 90,000 tons per annum. Finally, a town of the 220,000 inhabitants under discussion should burn for all purposes (say) 100,000 tons of coal, &c., per year, even if it is not a place where many manufacturing operations are performed; and if the appliances used for heating by means of gas have an efficiency of about 80 per cent., the total demand for heating gas should reach 3700 million cubic feet per annum, which, with the 500 millions now consumed in the development of light, should render the total consumption 4200 million cubic feet. In other words, the consumption per head should increase from 2200 to 19,500 feet.

PRESENT METHODS OF MAKING GAS.

It has now to be considered how such large quantities of gas could best be made. Under present conditions the smallest gas-works which can be profitable is one having an annual make of about $5\frac{1}{2}$ million cubic feet; but the largest factory it is possible to manage is hardly capable of definition. The methods that are employed for making gas on a very large scale are defective, inasmuch as the plant is scarcely modified from its standard form whether each unit is to treat $\frac{1}{2}$ ton or 500 tons. Thus the buildings and the apparatus itself increase in expense almost in proportion to the magnitude of the undertaking. At present a gas-works has to be erected in a spirit of compromise, so as equally well to suit the conditions prevailing in the summer and those in the winter. If the consumption of gas could be stimulated on the lines already described, and the demand for heating gas greatly increased, variations in the time of day would affect the process of manufacture much less than they do now; but alterations in the time of the year would become more noticeable. Papers have already been read at the Mannheim meeting pointing out the advantages of inclined and vertical retorts, and at the Dublin meeting of the British Institution reference was made to the use of coke-ovens in gas-works. Mr. Schlicht, too, has described the employment of recovery coke-ovens for the production of gas. But his idea has been to improve the atmospheric conditions of a city by increasing the consumption of coke. This scheme, according to Herr Kobbert, is not a complete solution of the question, for the latter desires to see the complete abolition of all solid fuel. The present author would accordingly prefer to gasify the whole of his coke, using as the gas-making vessel a vertical coke-oven.

In order to examine the phenomena that would arise if all the demand for artificial light and heat in a town were to be supplied from a gas-works, the annexed calculations may be made. If it is assumed that the calorific power of a flaming coal is 12,600 B.Th.U. per lb., and its efficiency is 60 per cent., if the calorific value of gas is 450 B.Th.U. per foot and its efficiency 80 per cent., if a little under 11,000 feet of gas are made per ton of coal, the production of heat in the form of gas which should replace the solid fuel now consumed would require the carbonization of about five times the quantity of coal now burnt and about $2\frac{1}{2}$ times that of the saleable coke. These figures limit the production of gas; for if about $1\frac{3}{4}$ lbs. of light oils, having a calorific value of 17,000 B.Th.U., are obtained per ton of coal, there could be made 25·6 cubic feet of gas having a calorific power of 290 B.Th.U. from each pound of coke; whereas for the production of gas having a calorific power of 450 B.Th.U. it would be necessary to obtain 54·5 cubic feet. Hence it is only possible to lower the calorific value of the gas or to use carburetting materials obtained from sources other than coal. It is difficult to foretell at present what may come of the new experiments upon the manufacture of blue water gas from creosote oils; but the employment of carburetting agents not derived from coal itself is a question having only local and occasional importance. In the town already discussed, there are 39,000 rooms not heated with gas; and they should consume, at the outside, 60,000 tons of coke to warm them. If they were heated by gas, the corresponding amount of coke thrown on the market would be 230,000 tons.

The question of cost remains to be considered. The gradual introduction of machinery into gas-works renders the manufacturing costs more uniform or alters their incidence, but does not greatly reduce them; for the apparatus has inevitably to remain incompletely used for months at a time. If the gas were made in coke-ovens, the engineer's ability to fire them either with coke or with coal gas would help to keep the plant running at uniform speed; while, moreover, the adoption of such large carbonizing units would render the recovery of bye-products more perfect than it is at present, even when many thousand retorts are under fire in the same house. Furthermore, the coke made in ovens could be sold over a larger district than is now possible, because it would be harder. The nitrogen would be more perfectly recovered and the sulphur might be isolated, even on the gas-works. The non-manufacturing costs on a gas-works are very high at the present day. Per unit of gas made, these costs, in a retort-house fitted with inclined retorts carbonizing 15 tons per day and yielding 160,000 cubic feet of gas, stand to the costs of a coke-oven consuming 5·6 tons per twenty-four hours, in the proportion of 5500 to 2000—a proportion which is notably increased by the traditional method in which gas-works are constructed. Finally, the buildings where the gas is purified occupy so much ground as to be extremely expensive.

THE AUTHOR'S PLAN FOR MAKING CHEAP GAS.

All these different sources of additional expense appeared so important that when the gas-works at Königsberg had to be enlarged it was decided not to install any oil carburetting plant for the water gas. By so doing it was found possible to adopt a method of washing the gas which permitted a larger quantity of nitrogen to be recovered, and enabled the existing buildings to be more profitably utilized than would otherwise have been the case, even allowing for the unusually high price demanded for sulphuric acid in the neighbourhood. For example, in a building which, when the apparatus was constructed in the ordinary manner adopted in 1900, was equal to a production of $1\frac{3}{4}$ million feet per day, six washers were erected for the recovery of tar, liquor, cyanogen, and ammonia, capable of treating 4 million per day. Furthermore, the ammonia and the cyanogen could be obtained in a merchantable form, either together or separately, and the building which formerly only sufficed for distilling the ammonia became large enough for the manufacture of ammonium salts. As resulting from the experiments of Dr. Wolffram, Dr. Hurdelbrink, Herr Walter Feld, and the German "Gesellschaft für Kohleverwertung," the method employed for washing the gas is somewhat as follows: Each of the six washers mentioned is a vertical tower divided into numerous superposed chambers fed with liquid from a pipe at the top, which revolves, according to the size of the apparatus, at the speed of from 120 to 180 revolu-

tions per minute, so that the centrifugal force propels the reagent against the sides of the vessel and causes a uniform distribution of fine drops through which the gas passes from below upwards. Without any preliminary cooling, the gas first passes to the tar-washer, the condensed liquid in which causes the tar vapours to separate. It next travels to the second washer, fed with water at from 80° to 100° C., where the ammonia is removed. The third washer is charged with ferrous sulphate for the separation of cyanogen. In order to prevent the absorption of ammonia, lime is added, so that the product is a solution of calcium ferrocyanide. The ammonia washers are charged with a cream of anhydrous gypsum. The carbon dioxide in the gas causes the formation of calcium carbonate, which can be easily removed in filter presses, while the liquid is evaporated to obtain ammonium sulphate. The next washers are employed to remove the sulphur by Feld's wet process [compare "JOURNAL," Vol. XCVIII., p. 85], a tar oil being used by which the sulphurous acid is absorbed. The sulphuretted hydrogen of the gas after the ammonia has been removed reacts with the sulphurous acid to yield free sulphur; and the latter separates on standing.

On a gas-works run on the usual lines, where, owing to the price of sulphuric acid, ammonium sulphate can only be obtained from the cyanogen sludge, the yields of bye-products per metric ton of coal are somewhat as follows: Strong aqueous ammonia 1·27925 kilos., ammonium sulphate 0·15632 kilo., cyanogen filter cake 0·10627 kilo., Prussian blue 0·71689 kilo. (worth, in good average German conditions, 124 pf. altogether); while 0·51067 kilo. of quicklime and 1·7931 kilos. of ferrous sulphate (costing 7·4 pf.) are consumed (showing a net gain of 116·8 pf. per metric ton). In the Feld washer, on the other hand, where the yield of ammonia is not dependent on the temperature of the washing liquid, the amount of ammonium sulphate obtained is 2·2 kilos., and of Prussian blue in the form of calcium ferrocyanide 1·4 kilo., per metric ton (value 254 pf.); whereas the consumption of reagents, allowing for a sufficient excess in each case, is 13·86 kilos. of gypsum, 1·4938 kilos. of ferrous sulphate, and 1·07421 kilos. of quicklime (costing 38·5 pf.). Thus per metric ton of coal the money value of the bye-products recovered is 215·5 pf., instead of 116·8 pf., showing an increase of 98·7 pf. For a consumption of 40,000 tons of coal, this represents an increase in revenue of some £1970 over and above the avoidance of the depreciation and interest on a second condensing and washer house, which would cost about £1900. In building a new works altogether, considerably greater economy could be effected. For instance, a condenser and washer house, with all necessary accessories for an annual make of about 700 million cubic feet could be erected for about £23,000; whereas the same structure would hold a Feld plant of treble the capacity, and would cost about £42,000—the interest and depreciation on the latter per unit of gas being a little more than half that of the former. In fact, the author considers that a coke-oven factory having an annual capacity of 5000 million feet could be erected at such a price that, allowing for a 4 per cent. sinking fund on the capital and 5 per cent. depreciation, gas of 450 B.Th.U. per cubic foot could profitably be sold at 7d. or 8d. per 1000 cubic feet—practically the price at which heat can be obtained from solid fuel to-day.

Herr Kobbert concludes his paper by a confident statement that his foregoing estimates are not empty visions, but are the result of careful calculations and actual experience.

The Next Examinations in "Gas Manufacture."

We have received from the Superintendent of Technological Examinations of the City and Guilds of London Institute (Sir Philip Magnus, M.P.) the programme for the ensuing session, containing the regulations for the examination of candidates in technological subjects. It is notified that next year, as already intimated in the "JOURNAL," separate examinations will be held in "Gas Engineering" and "Gas Supply;" and they will include questions on such subjects as will be found set out on pp. 50-55 of the programme, as well as in the "JOURNAL" for the 4th ult. (p. 650). Lists of books bearing upon the two subjects are given at the end of the proposed questions. The examinations for both grades will be held from 2.30 p.m. to 6.30 p.m., on Saturday, May 9; the Examiners being, as already mentioned in our columns, Mr. A. F. Browne, of Vauxhall, and Mr. J. H. Brearley, of Longwood. Intending candidates may be reminded that the first prize in the Honours grade is £2 given by the Salters' Company and the Institute's silver medal. There are two prizes in the Ordinary grade—viz., the first, of £1, given by the Salters' Company and the Institute's bronze medal; and the second a bronze medal.

At a recent meeting of the Paris Académie des Sciences, a communication on the nature of sulphammonium was submitted by MM. Lebeau and Damoiseau. It was a repetition of the work of Henri Moissan and of Herren Otto Ruff and Geisel. According to "Nature," the latter indicate a reversible reaction between sulphur and ammonia; giving rise to nitrogen sulphide and ammonium sulphide. In the present paper it is shown that if minute precautions are taken to ensure the complete absence of moisture, neither nitrogen sulphide nor ammonium sulphide is formed. The weight of sulphur recovered after evaporation of the liquid ammonia is exactly the original weight; and no trace of sulphuretted hydrogen is given off during the evaporation.

CARBONIZATION OF DURHAM COKING COAL.

At a Meeting of the Newcastle Section of the Society of Chemical Industry early this year, a paper on "The Carbonization of Durham Coking Coal and the Distribution of Nitrogen and Sulphur" was read by Mr. ANDREW SHORT, B.Sc. The text of the paper was given in the "JOURNAL" of the Society for the 15th ult., from which it has been reproduced.

The carbonization of coal by destructive distillation has been the subject of many investigations, both in the laboratory and on a large scale. The following notes refer particularly to the carbonization of Durham coal coked in patent coke-ovens.

In coke-works, the methods are somewhat similar to those adopted in gas-works; the chief difference being a question of the ultimate product. In a patent coke-oven, the quantity of coal dealt with in a charge is much greater, and the time required for carbonization much longer, than in gas-works practice. Hence the conditions required and the products of distillation differ somewhat in the two cases. The temperature of carbonization is probably higher in coke-ovens than in most gas-works; moreover, it is not so easy to prevent the admission of air into a coke-oven as it is with a gas-retort.

The investigations here described were carried out on a battery of patent coke-ovens of the Otto-Hilgenstock type; the plant belonging to the Priestman Collieries, Limited, at Blaydon-on-Tyne. The ovens are rectangular chambers some 33 ft. long, 6 ft. 6 in. high, and from 20 in. to 22 in. wide. They are fired by gas, which is burnt in large bunsen burners, arranged underneath vertical flues. The charge of coal is about 6 tons 15 cwt. The gases are led off by an ascension-pipe into a gas-main, and by means of exhausters are drawn through air and water coolers, and then forced through scrubbers, as is usual in gas-works. The gas is then returned to the ovens, where it is burnt in the flues for the purpose of carrying on the distillation of the coal.

TABLE I.—*Percentage Analysis of Gas at Various Periods of Carbonization.*

—	After 1 Hour.	After 6 Hours.	After 11 Hours.	After 16 Hours.	After 21 Hours.	After 26 Hours.	Later Test. Oven Off Main.
Carbon dioxide	1·4	2·2	1·4	1·0	1·0	1·4	0·8
Unsaturated hydrocarbons	5·6	5·0	3·4	1·4	0·2	0·0	0·0
Oxygen	0·8	0·8	0·7	0·2	0·2	0·4	0·0
Carbon monoxide	5·4	4·9	4·3	4·4	4·6	9·2	5·4
Hydrogen	39·2	44·8	47·9	54·5	62·6	59·2	76·8
Methane	41·1	36·1	34·1	29·8	23·0	4·0	4·5
Nitrogen	6·5	6·2	8·2	8·7	8·4	25·8	12·5

Average Analysis of Gas.

	Per Cent.
Carbon dioxide	1·8
Unsaturated hydrocarbons	3·8
Oxygen	0·6
Carbon monoxide	5·0
Hydrogen	51·5
Methane	28·4
Nitrogen	8·9
	100·0

Calorific value (net), 500 B.Th.U. per cubic foot.

The figures given in Table I. are the results of experiments made with a view to showing some changes taking place during the distillation of coal in such ovens. It will be seen that at the commencement of distillation, when the temperature of the charge is low, the gas given off is rich in illuminants and relatively poor in hydrogen. As coking proceeds, the oven becomes hotter, and the gases suffer by reason of the increase in temperature, and alter gradually in composition. The percentage of hydrogen increases steadily, and methane and olefines decrease in proportion. The tests were taken at intervals of five hours; the gas being drawn off from the ascension-pipe at a point some 2 ft. 6 in. from the base. The analysis of gas at the 26th hour is somewhat interesting, as it shows a decrease in the percentage of hydrogen, and a corresponding increase in carbon monoxide and nitrogen. This is explained by the fact that the ovens are never absolutely air-tight; so that when the volume of gas given off decreases, as it does towards the end of the coking period, there is a slight suction exerted on the oven by the exhausters which draw off the gas. The result is that a little air has been drawn in, and has evidently burnt up part of the hydrogen and the carbon. Thus there is an increase in the proportion of carbon monoxide, and a considerable percentage of nitrogen has been introduced. In order to find the effect of relieving this suction, the same oven was afterwards shut off from the gas-main, and the ascension-pipe cap was removed, so that the gas found its way naturally into the air without any suction being exerted on the oven. A sample of the gas was drawn off; and the analysis is shown in the table. The hydrogen exhibits a great increase, while the proportions of carbon monoxide and nitrogen are considerably diminished. [The evolution of ammonia was shown on a chart, and also the temperature of the gases leaving the oven. The changes were

such as might be expected after studying the changes recorded in Table I.]

It is a well-known fact that ammonia decomposes on heating. This has been illustrated by Lunge, who shows that when ammonia is passed through a tube heated to 600° C. filled with broken porcelain, 34·14 per cent. is decomposed with a slow current of ammonia, and 21·36 per cent. with a rapid current; while at 780° C. the decomposition is complete. Thus it is important that the temperature in the top of the oven should be kept down as far as practicable, and that the gases should be led off as quickly as possible.

In order to see whether a mixture of a large excess of coal gas together with a relatively small quantity of ammonia exercised any protecting influence on the ammonia, I tried the following experiment: A sample of gas, taken from the main, immediately before entering the scrubbers, was drawn through a tube of Jena glass 2 feet long, filled with broken pieces of fire-brick. The tube was heated to a full red heat in an ordinary Erlenmeyer furnace, and the gas was drawn, in a moderate stream, through the red-hot tube, with the following result:—

	Grammes per Cubic Metre.
Ammonia in gas before entering tube	5·26
,, ,, after leaving ,, ...	3·77
Ammonia decomposed	1·49

Thus the ammonia suffered decomposition to the extent of 28·3 per cent.

The decomposition of ammonia in the oven probably takes place in two ways—*viz.*, dissociation into nitrogen and hydrogen, and, by contact with the red-hot coke, production of cyanide of ammonia and evolution of free hydrogen—$2NH_3 + C = NH_4CN + H_2$. Thus we might expect with a higher temperature of carbonization an increase in cyanogen.

TABLE II.—*Variation of Cyanogen in Liquor with Increased Temperature.*

Date.	Gas Pressure.	Ascension Pipe Temperature.	Ammonia in Liquor.	Hydrocyanic Acid in Liquor.	Hydrocyanic Acid per 100 Parts of Ammonia.
1906.	In.	Deg. F.	Grms. per 100 c.c.	Grms. per 100 c.c.	
Sept. 21	1·20	1069	1·26	0·025	1·98
,, 26	1·20	1086	1·41	0·028	1·99
Oct. 3	1·23	1086	1·26	0·029	2·30
,, 16	1·27	1121	1·34	0·035	2·61
,, 23	1·28	1170	1·48	0·032	2·17
Nov. 15	1·27	1165	1·60	0·038	2·37
Dec. 6	1·27	1150	1·59	0·043	2·70
,, 20	1·27	1150	1·50	0·041	2·70
1907.					
Jan. 18	1·26	1200	1·46	0·036	2·46
,, 22	1·27	1210	1·63	0·043	2·64
Feb. 6	1 27	1200	1·56	0·038	2·43
,, 19	1·25	1130	1·51	0·032	2·12
,, 26	1·27	1176	1·69	0·041	2·43
..	..	..	1·48	0·035	..

Table II. shows the variation in cyanides contained in the ammoniacal liquor with increasing gas pressure on the burners; and therefore increased temperature in the oven flues. The table gives the gas pressure, the temperature of gas in the ascension-pipes, and the percentages of ammonia and cyanogen as cyanides in the liquor. As the strength of the liquor varies from day to day, the relative proportion of cyanide to ammonia has been calculated. It will be seen that as the pressure of gas is increased, the temperature of the gases leaving the oven also rises, and an increase in the amount of cyanogen follows. The discrepancies in the table can be explained by the fact that the tests were taken only at intervals. The general trend is, however, shown fairly clearly to be an increase of cyanogen with higher temperature; the cyanide resulting from the decomposition of ammonia.

A comparison of the conditions existing in the various forms of retort used for the distillation of coal affords an interesting study. In the horizontal gas-retort we have a comparatively small D-shaped retort heated all round by the flue gases. The coal is charged into this red-hot retort, and lies in a more or less thin layer on the bottom, leaving a considerable space above it. The retort is cooled somewhat by the coal. As distillation proceeds, the temperature of the retort increases, and the gases coming off come in contact with the hot sides and top of the retort. That decomposition takes place is seen from the thick deposits of carbon on the roof of the retort—this carbon being to a large extent the product of decomposition of hydrocarbons in the gas. Towards the end of the distillation, the charge becomes very hot, and more decomposition takes place—resulting in the production, during the later stages, of a gas low in hydrocarbons and rich in hydrogen (the hydrogen being a result of the decomposition of the hydrocarbons). The ammonia yield also suffers, especially when the temperature of distillation is high, as is the case in most modern gas-works; and the quality of the tar also deteriorates. On the other hand, the charge is worked off more quickly than in a coke-oven.

This decomposition has been fully realized, and attempts have been made to overcome the difficulty by adopting different methods of carbonization. One, and perhaps the most successful from a chemical point of view, is the vertical gas-retort, forms of which are being worked both in this country and on the Continent. This type of retort consists of an upright cylinder into which the coal is charged from the top. The charge practically fills the retort, which is heated from the outside; the heat gradually penetrating to the centre. The gas evidently takes its course up through the comparatively cool core to the top of the retort, where it immediately enters the ascension-pipe at a low temperature, and is drawn off without further contact with the highly-heated sides of the retort, and so is not liable to undergo further decomposition. Bueb, in a description of the vertical gas-retorts of the Dessau type, gives the average yield of ammonia from vertical retorts as 3·11 kilos. per ton of coal, and from ordinary retorts 2·32 kilos.—an increase of 34 per cent. in ammonia yield. He also states that the quality of the tar is greatly improved, as it contains a much larger proportion of benzene and its homologues, is thinner, and practically free from suspended carbon. Besides, the coke produced in the vertical retort is harder than that from horizontal retorts.

In the horizontal coke-oven there is a large rectangular chamber some 33 feet long by 6 ft. 6 in. high and 2 feet wide which is almost completely filled with coal, leaving only a relatively small space at the top for the exit of the gases. Coking proceeds from the sides inwards, and the heat gradually penetrates to the core. This oven would seem to combine some of the features of both vertical and horizontal gas-retorts. For instance, the centre of the charge remains at a comparatively low temperature for the greater part of the coking period, rising at the centre only towards the end of the distillation. The temperature of the flues is at least 2000° Fahr., while that of the gases leaving the oven is only 1000° to 1200° Fahr. It is thus reasonable to suppose that a proportion of the gas rises through the cooler centre core, as is contended to be the case in the vertical retort, especially as the coke in the centre, near the top of the charge, is frequently a little honeycombed, while that on the outside is always hard and dense. The gas must, however, as in the horizontal retort, pass under the hot top of the oven on its way to the ascension-pipe; and if this surface is highly heated, decomposition will take place. The volume of the space above the coal is, however, much smaller, compared with the bulk of the charge, than in the horizontal retort. In any case, the yield of ammonia is very similar to that from a horizontal gas-retort; and the tar is moderately low in free carbon, when compared with that from gas-works, working at high temperatures. A vertical coke-oven, with recovery of bye-products, has recently been patented by Mr. A. O. Jones; and it will be interesting to see, when this oven is in use, whether the improvements obtained by Bueb and others with vertical retorts are repeated with a vertical coke-oven which is similar in principle.

Distribution of Nitrogen.—Figures showing the distribution of nitrogen have been published by various authors, among whom are Foster, Knublauch, and recently M'Leod. Foster's figures relate to English coal, Knublauch's to German, and M'Leod's to Scottish coals.* Some of the data are tabulated below:—

Nitrogen.	Foster.	Knublauch.	M'Leod.
	Per Cent.	Per Cent.	Per Cent.
As ammonia	14·50	12 to 14	17·1
As cyanogen	1·56	2·0	1·2
In the coke	48·68	50·0	58·3
In the tar	35·26	30·0	3·9
In the gas			19·5

The figures given below were obtained from the results of actual working on the large scale in coke-oven practice, and most of them over a considerable period; the object being to obtain results over an extended period rather than from isolated tests or mere laboratory distillations. The following method was adopted: The average percentages of nitrogen were determined in the coal, coke, and tar, in the ammoniacal liquor, and in the end gas after leaving the scrubbers, together with the yields of these various products. The total quantity of coal carbonized during six months was calculated back to dry coal, the average moisture in it being known; and the quantity of coke made was similarly calculated to dry coke. The moisture was determined in each by daily tests. To the coke figure was added the coke breeze and ballast, also calculated to the dry material. This figure for "total coke" worked out at 76·44 per cent. on the dry coal. The yield of tar on dry coal was 4 per cent. The total quantity of ammonium sulphate made, each lot of which was analyzed, was calculated back to ammonia. To this figure was added the ammonia in the spent liquor from the stills; and thus a figure was found for total ammonia in the gas liquor, and calculated back to the percentage yield of ammonia on the dry coal. This figure worked out to 0·288 per cent. From the analysis of the ammoniacal liquor in Tables III. and IV., we get the distribution of nitrogen in it as ammonia, cyanide, and sulphocyanide (any nitrogenous organic bodies contained in the liquor were neglected). Having these proportions, and knowing the percentage of the nitrogen in the coal which is actually obtained from the liquor as ammonia, we can get the relative proportions of the nitrogen yielded as cyanide and sulphocyanide in the liquor. The analysis of the liquor must be performed on the fresh sample, since on keeping the liquor for a time the cyanide disappears, probably reacting with ammonium polysulphide, produced on standing, from the ammonium sul-

* See "JOURNAL," Vol. XCVII., p. 748.

phide, to form ammonium sulphocyanide. For example, a fresh sample of liquor gave 0·042 per cent. of hydrocyanic acid. After seven days the percentage had dropped to 0·027, and after 21 days to 0·009.

TABLE III.—*Analysis of Ammoniacal Liquor.*

	Grammes per 100 c.c.
Ammonia—Free	1·41
,, Fixed	0·11
Total	1·52
Sulphur—	
,, As sulphuretted hydrogen	0·237
,, as sulphocyanides	0·013
,, as thiosulphate and sulphite	0·008
,, as sulphate	0·004
Total	0·262
Carbon dioxide	1·490
Cyanides—	
Ferrocyanides	*nil*
Cyanides (as HCN)	0·0360
Sulphocyanides (as HCN)	0·0119
Chlorides (calculated as HC)	0·1530

TABLE IV.—*Distribution of Nitrogen and Sulphur in Liquor.*

	Per Cent.
Nitrogen—	
,, As ammonia	98·31
,, as cyanides	1·47
,, as sulphocyanides	0·22
	100·00
Sulphur—	
,, As sulphuretted hy hydrogen	90·46
,, as sulphocyanides	4·96
,, as sulphite and thiosulphate	3·05
,, as sulphate	1·53
	100·00

There now remains the nitrogen in the gas. The cyanogen is only partially extracted by the scrubbers. The portion remaining in the gas was estimated by the prussian blue method; the small quantity of residual ammonia in the gas being estimated in the usual way. Assuming that a ton of coals yields 10,000 cubic feet of gas, the percentage of the nitrogen of the coal which remains in the end gas as cyanogen and ammonia can be calculated. The figure 10,000 cubic feet for the yield of gas is assumed, since in coke-works the gas is not measured as it is in gas-works. Table V. gives the various figures for the nitrogen distribution. The difference figure is taken as free nitrogen in the gas. This it is impossible to verify, as under the best working conditions some air is liable to be drawn into the oven.

TABLE V.—*Nitrogen Distribution.*

[The dry coal contains 1·57 per cent. nitrogen.]

—	—	Calc. to Dry Coal.	Total Nitrogen.	Total Nitrogen.
	Per Cent.	Per Cent. Nitrogen.	Per Cent.	Per Cent.
Nitrogen—				
In coke	0·89	0·680	..	43·31
In tar	1·17	0·047	..	2·98
Nitrogen as ammonia—				
(*a*) In liquor	1·52 NH_3.	0·237	15·100	15·16
(*b*) In end gas	..	0·001	0·060	
Nitrogen as cyanogen—				
Cyanides in liquor	0·036 HCN.	0·0035	0·226	
Cyanides in end gas	55·54 grs. 100 cb. ft.	0·0183	1·170	1·43
Sulphocyanides in liquor	0·013 sulphur as SCN.	0·0005	0·033	
Nitrogen in gas and loss (difference)	..	0·5827	..	37·12
	..	1·5700	..	100·00

That the length of time of distillation influences the percentage of nitrogen left in the coke has been shown by Anderson and Roberts, who find that if coal is quickly carbonized a much larger proportion of nitrogen is retained in the coke than is the case with slow carbonization. In a laboratory distillation with the coal used in the above investigations, I found that 64·91 per cent. of the nitrogen of the coal remained in the coke—a result eonsiderably higher than that obtained on the working scale. The length of time of distillation was, in the laboratory experiment, about three hours, as against 28 to 29 hours on the large scale. The average percentage of nitrogen yielded as ammonia in the laboratory distillation was 16·05 per cent.

Distribution of Sulphur.—The figures for the distribution of sulphur were obtained in a manner similar to those for the nitrogen distribution. The average sulphur contents of coal, coke, and tar were determined; and the percentages of sulphur re-appearing in the coke and tar were obtained from these figures. The analysis of the ammoniacal liquor gives the ratio of ammonia to sulphur in it. The ammonia obtained from the liquor corresponds to a certain percentage on the coal. From the ratio of ammonia to sulphur we can calculate back the sulphur contained in the liquor to the percentage on the coal. Knowing the sulphur content of the coal, we can easily calculate the percentage of the sulphur which appears in the liquor. The distribution of the sulphur in the liquor is shown in Table IV.

The sulphur in the gas existing as sulphuretted hydrogen was determined, and also the sulphur compounds other than sulphuretted hydrogen which are contained in the gas. Assuming as before that a ton of coal yields 10,000 cubic feet of gas, the figures can be calculated back to percentage on the sulphur contained in the coal. The distribution of sulphur is shown in Table VI.

TABLE VI.—*Sulphur Distribution.*

[The dry coal contains 0·824 per cent. sulphur.]

—	—	Calc. on Dry Coal.	Total Sulphur.	Total Sulphur.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Sulphur—				
In coke	0·782	0·598	..	72·53
In tar	0·300	0·012	..	1·45
Sulphur as sulphuretted hydrogen—				
(*a*) In gas	240·600 Grs. per 100 Cub. Ft.	0·153	18·56	24·00
(*b*) In liquor	0·237	0·045	5·44	
Sulphur as compounds other than sulphuretted hydrogen—				
(*a*) In gas	14·920 Grs. per 100 Cub. Ft.	0·009	1·149	1·72
(*b*) In liquor	0·025	0·004	0·574	
Difference, loss, &c.	..	0·003	..	0·30
	..	0·824	100·00	100·00

It was necessary to make the tests on the gas when the sulphate plant was shut down, since the waste gases from the saturators are passed back into the gas-main and mix with the gas from the ovens—being ultimately burned in the flues. Since these gases consist mainly of sulphuretted hydrogen and carbon dioxide, together with a small quantity of hydrocyanic acid, these compounds would come out abnormally high under ordinary working conditions.

A MAXIMUM AND MINIMUM PRESSURE GAUGE.

A recent issue of the "Journal für Gasbeleuchtung" contains an illustrated article describing an automatic maximum and minimum gas-pressure gauge which was exhibited by its inventor, Herr F. Lux, of Ludwigshafen, a short time ago before two of the Provincial German Gas Associations.

As shown in fig. 1, the apparatus consists of the ordinary U tube used for pressure-gauges, one limb of which has a lateral opening joined to a depending member terminating in a cock at the base. If, now, the U tube is filled to such a level that the liquid is on the point of overflowing into C, and the limb A is connected to a pipe in which gas is present under a positive pressure, some of the liquid overflows from B into C, and the height of the column in C is a measure of the pressure prevailing. When the pressure

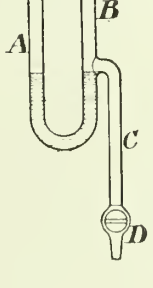


Fig. 1.

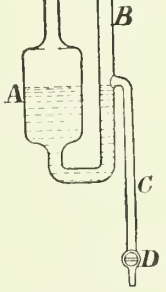


Fig. 2.

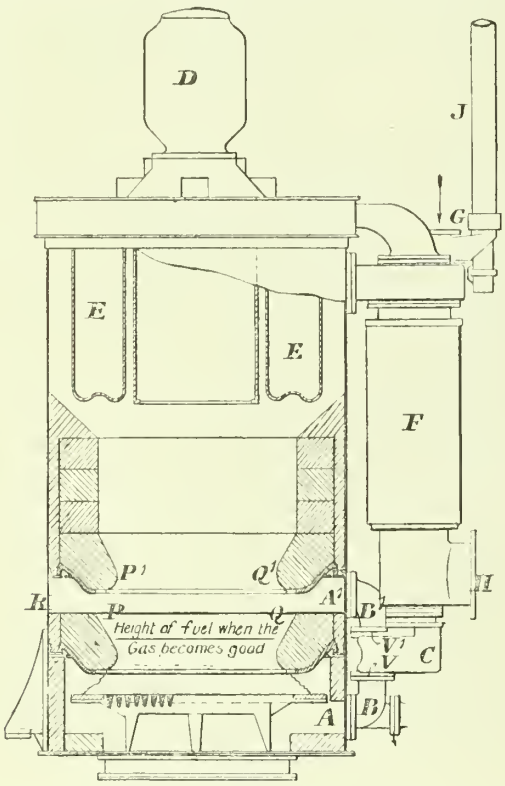
rises still further, more of the liquid runs over into C, and therefore the quantity of liquid in C at any moment is an indication of the maximum pressure of the gas since the instrument was last set by opening the cock D and adding fresh liquid. Conversely, if the limb B is connected to a pipe in which gas is present, under a negative pressure, and the apparatus is then filled with liquid until it is on the point of overflowing, any decrease of pressure in the pipe causes liquid to run over into C, and this height is again the measure of the change in pressure—in this case minimum pressure. By making the tube C much smaller than A and B, as represented in fig. 2, the instrument gives enlarged readings, and thereby becomes more delicate. For practical purposes the gauge may be used in duplicate; the limb B being fitted with a stop-cock pointing upwards, and then being turned down again

so as to become the limb A of a second gauge. So arranged the apparatus may be placed between the hydraulic main and the exhauster in order to show the lowest vacuum that has prevailed there during (say) the last 24 hours. By connecting both limbs of the double apparatus to a distributing system, the gauge will show the maximum and minimum pressure since the last time of reading; or it may be employed to indicate the maximum difference in pressure between the inlet and outlet of a purifier.

SUCTION PRODUCERS.

DIFFICULTIES AND DANGERS IN PURIFYING POOR GAS.

M. Camille Roche, in a paper read before the Société Technique du Gaz pointed out the uncertainty existing as to the purification required for poor gas. Various replies are given to the questions: Is it necessary to take out the sulphur? and, Can it be burned in the engine? On one point all are agreed—namely, that gas arriving at the engine should be freed from all dust and tar. As with illuminating gas, there is physical purification and chemical purification. The former is effected by condensers (Pelouze) and washers; the exhauster being interposed between the first two. Chemical purification is done in the purifiers. The same practice has been followed, for the most part, also for poor gas; but the author's conclusion from experience in working is that important modifications ought to be made; his object being to show the little use there is for a chemical purifier after a good washer.



A A'. Air Inlets. B B'. Air Inlet Pipes. C. Chamber at Bottom of Superheater. D. Hopper. E. Boiler. F. Superheater. G. Air Inlet to Superheater. H. Gas Outlet to Hydraulic Main. I. Air Inlet to Fan. J. Chimney. PP'QQ'. Fuel Levels. R. Sight Holes. VV'. Valves.

Roche's Suction Producer.

He describes a producer (see illustration) for an engine of 200 to 250 H.P. Its circular grate is 900 mm. (35½ inches) diameter, and has a surface of 65 square decimetres (1007 square inches). The air for combustion enters at two cylindrical points, one above the other, A and A', through pipes B and B'. Regulation is effected by the valves V and V'. This air reaches the chamber C at the bottom of the superheater, after having been charged with steam in the boiler and in the superheater itself. Lighting up is done by blowing from the fan; the two valves V and V' being shut. The air enters at A. The gas becomes good when the bed of anthracite is about 250 mm. (10 inches) thick. The total surface of air on the fuel is 1·25 square metres (1937 square inches) for 200 to 250 horse power, or 60 square decimetres (930 square inches) per 100-horse power.

This producer was adopted after many tests, and has given the best results. It has been well thought out in its details—more especially from the point of view of cooling the gas produced. There is an outside regenerator where the air for combustion is heated by contact, and is moistened by a fine spray, which becomes vaporized. The gases produced at a temperature of about 1200° C. leave the producer at a temperature varying between 100° and 200° C. according to the make. The gas-pipes to the engine are 250 mm. (10 inches) in diameter. The washer is placed after the hydraulic main; and it performs the double function of cooling the gas and arresting the tar and dust. The amount of water used is about 15 litres (3·3 gallons) per horse-power-hour, and at the outlet has a temperature of about 40° C. (104° Fahr.). In the washer the sulphurous and hydro-sulphuric gases, in contact with the water and the dissolved oxygen of the air, become decomposed, with the formation of water and deposit of sulphur. The greater part of this sulphur is undoubtedly carried away by the water of the washer.

A ferro-concrete purifier (6 m. by 5 m. by 1·80 m.) was placed after the washer; and at the moment of starting it absorbed a pressure of 10 to 15 mm. After a month, the two tiers of oxide of iron, each 400 mm. (16 inches) thick, became moist, and took 200 mm. pressure. This material, saturated with water, no longer allowed gas to pass. When dry, it showed no change of colour, nor of texture, nor of weight, nor any chemical reaction. Perhaps, at the outlet of the washer, the gas did not contain any sulphur, or the sulphur was not in a state of being able to act on the hydrated oxide of iron; or, again, the sulphur may not have been in the presence of the necessary bodies to react on the oxide, such as ammonia, cyanides, &c. Which of these theories is the true one, has not been ascertained. But the oxide was done away with, and the purifier filled only with tan. It played the part of a governor for, or fly-wheel to, the gas.

Two explosions occurred during the working. The engine was started by shutting the valve of the fan, and by fully opening valve V, and half opening valve V'. This was the mistake; for air entering at A' formed an explosive mixture, and when the fire reached the level PQ, explosion followed. In normal working, the fire is observed from sight-holes, R. It never reaches higher than the level P'Q'. Air can be introduced without danger at A' when working; for this air increases the activity of the fire and gas production, cools the clinker, and makes clinkering easier. But, when lighting up, on the contrary, as the fire is below the level PQ, and is not seen at R, the introduction of air at A' produces an explosive mixture, and the valve V' ought never then to be opened.

The author's conclusions are: (1) In a suction apparatus, re-entries of air are always to be feared; safety demands doing away with any gas storage, which is at any moment very likely to contain an explosive mixture. (2) On the other hand, the installation of hydraulic mains, washers, and pipes need not give rise to fears of explosion, either because the water contained prevents the whole catching fire, or on account of the large cooling area of the sides, which has the same effect.

Death of Mr. Herbert F. Burrows.

We regret to record the sudden death on the 30th ult., at his residence, Sefton Park, Liverpool, of Mr. Herbert Firth Burrows, partner with his brother, Mr. Freeman Burrows, in the Torbay Paint Company (Messrs. Stevens and Co.). Deceased, who was in his 48th year, was apparently in his usual health the previous day, and was playing golf in the afternoon. In the evening he was taken suddenly ill, and succumbed next day to heart failure. Deceased was one of the most prominent Freemasons in West Lancashire. He was P.M. of the Croxteth United Service Lodge (No. 786), a Founder and First W.M. of the Imperial Lodge (No. 2711), and a Past Prov. Grand Deacon of the Province. He was the Hon. Treasurer of the West Lancashire Alpass Institution for Widows of Freemasons, and one of the Hon. Secretaries of the Masonic Committee formed for the building of a Lathom Memorial Chapter House in the Liverpool Cathedral. He was initiated in the Lorne Lodge (No. 1347), Sutton, in 1881; and eight years later he was elected a joining member of the Croxteth United Service Lodge, and in 1898 of the Lathom Lodge (No. 2229), Southport. He was a Royal Arch Mason, having been exalted in the Sefton Chapter (No. 680), Liverpool, in 1890, and installed in the chair of First Principal in 1896. In 1893 and 1894, he served as Prov. G.D.C., and in 1897 was appointed Prov. G. Scribe N. He served as Steward for, and was a Life Governor of, the three Central Masonic Institutions, and likewise of the four which have been established by the Brethren of West Lancashire. At the Grand Festival of the United Grand Lodge of England in the spring of 1904, he was invested by the M.W. Grand Master as one of the Grand Deacons for the year. The funeral took place last Wednesday afternoon in the presence of a large gathering of Masonic Brethren and private and other friends, which testified to the great esteem in which the deceased had been held.

The Workmen's Compensation Act, 1906.—Now that public companies and business firms are beginning to realize the full effect of the above-named Act, attention may be called to a small volume, just issued by Messrs. Eyre and Spottiswoode, containing the text of the Act and the County Court Rules relating thereto, with notes. It is by Mr. F. L. Firminger, of Gray's Inn and the South-Eastern Circuit, who has aimed at making the book serviceable to the legal profession, Insurance Companies, and all whose business will necessitate reference to the Acts relating to workmen's compensation. The one passed in 1897 has proved fertile in litigation; and Mr. Firminger is of opinion that the Act of the past session will give rise to numerous decisions. The text, which is very fully noted, occupies 160 pages, and the seven appendices 100 pages more. There is an index to cases cited, as well as a general index. The price of the book is 5s.

REGISTER OF PATENTS.

Distilling Coals and other Hydrocarbonaceous Substances.

ALLISON, C. A.; a communication from the American Chemical Eduction Company, of New York.

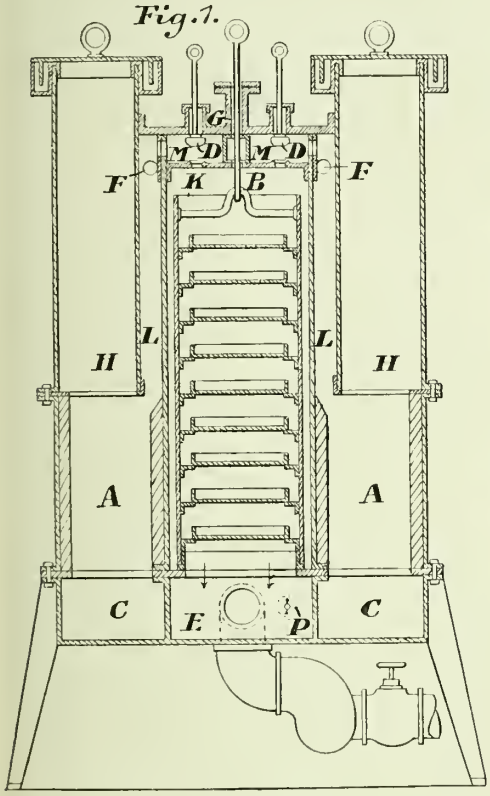
Nos. 11,925 and 11,926; May 22, 1906.

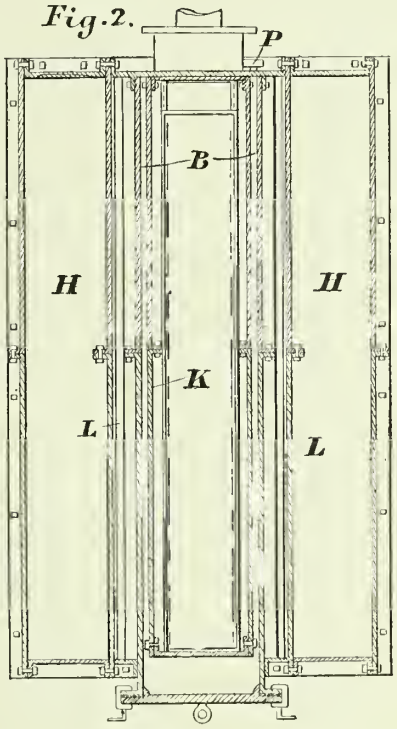
This invention relates to the distillation of solid hydrocarbonaceous materials—such as cannel and other coals, block and splint coals, shales, lignites, &c.—from which, by the application of heat, there are obtainable raw and crude oils and waxes, and that yield, when subjected to the proper processes, paraffins, hydrocarbon oils, phenols, creosols, naphthas, ammonia, and other products.

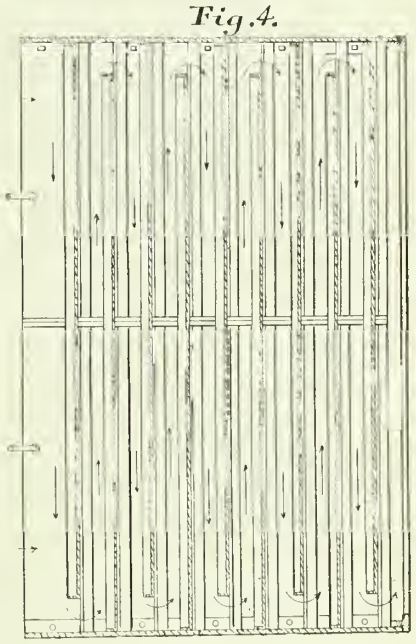
The distillation, if carried out at low temperatures for the purpose of producing lubricating oils, oil vapours, and waxes directly, and free from tar, benzol, naphthalene, sulphur, &c., has heretofore presented a difficult problem for solution, the inventors remark. Many processes have been suggested and attempted; but "none has proved of practical value when tested commercially, owing to the various defects which have interfered with their successful operation and prevented the obtaining of products capable of standing the commercial tests."

Where it has been proposed to destructively distil carbonaceous materials in a retort at a temperature of 750° Fahr. by means of a current of neutral gases (with or without external heating of the retort), by one method the substance has been deposited in a mass in the distilling chamber and air has been drawn into and through a fire from the top to support combustion—being thus, theoretically, deprived of its oxygen—and the gaseous products of combustion are drawn or forced through the body of material below the fire, and the vapours thrown off by the action of the heat on the material have been carried by the currents to the condenser. In another method the substance has been deposited in the chamber some distance from the fire, and the products of combustion drawn into the chamber over a bridge wall and caused to strike down on the material. By the former method, the substance melts under the heat and forms a more or less dense mass, which the gaseous products of combustion are unable to pass through; and when the operation has proceeded for a short time it must necessarily cease, because it is impossible to draw the air into the fire or the products of combustion through the material. Furthermore, it is evident that the draught will cause the fire to work down into and through the coal, which will be entirely consumed with the vapours distilled from it. In the second method, as only the surface of the material is acted upon directly by the heat currents, the great mass will not be distilled.

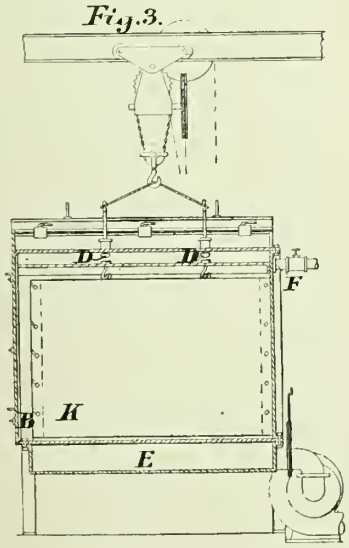
The present invention has for its object, first, to promote the rapid, continuous, and practically simultaneous distillation of an entire charge of coal without destruction of the solid carbonaceous residuum, depositing the charge divided into relatively small isolated bodies in a distilling chamber, and passing currents of gaseous products of combustion derived from a non-contiguous fire, heated to a temperature below red







American Chemical Eduction Company's Plant.



heat or incandescence—say, from about 700° to 800° Fahr.—into the chamber and over and under the several bodies successively, so that the distillation proceeds rapidly and practically at the same time in all the bodies. In this way the time required for distilling the charge is said to be greatly reduced; the distillation is complete; and the liability of dissociation of the initial products is avoided.

A second object is to ensure an uninterrupted movement of the distilling agent through the distilling chamber, and the contact thereof with the material. This part of the invention consists in dividing the charge into relatively small bodies, depositing these bodies on trays or shelves in the distilling chamber, adjusted to form a zig-zag passage through the chamber, and causing currents of gaseous products of combustion to pass through the passage and sweep over the tops of several bodies and under the shelves or trays, whereby the distillation is caused to proceed rapidly, continuously, and uniformly through the several bodies.

A third object is to prevent dissociation of the initial products of the distillation of hydrocarbonaceous substance—oils, oleaginous vapours, vapours of paraffin, phenols, &c.—by the heat of the distilling agent and that engendered in their production, by producing a current of the hot gaseous products of combustion through the distilling chamber and over and under the bodies of the substance undergoing distillation, and sweeping away the hot products of combustion and the oils and vapours from the inflowing heat by means of the current as rapidly as they develop, and carrying them out of the distilling chamber to the condenser.

A fourth object is to produce a uniform distillation of the charge, and thus reduce the time required for the distillation, prevent destruction of the residuum, and the dissociation of the initial products by exposing one or more parts of the charge to the heat for a longer period than other parts. This part of the invention consists in dividing the charge into relatively small isolated bodies, subjecting them separately and contemporaneously to the action of the gaseous products of combustion, separating the vapours as fast as they are developed from their source, and removing them from the distilling chamber as rapidly as they are thrown off.

The nature of the process is "wholly dissimilar from the destructive distillations earlier mentioned, and, inasmuch as the initial products are obtained from such substances without dissociation, the initial products are free from tar, naphthalene, benzol, &c., and an abundance of dense lubricant oils and of solid paraffin wax are produced."

The invention further comprises distilling coals (particularly cannel coals) by means of the deoxidized products of combustion derived from a fire separated from the coal undergoing distillation, or by means of neutral gases, at a temperature below that which produces red heat or

incandescence, and reducing the pressure of the distilling medium by exhausting it from the chamber in which the distillation takes place, thereby creating currents of the heated products of combustion or the neutral gases through the chamber, and drawing them, together with the vapours distilled from the coal, out of the chambers as they are formed, to prevent increase of temperature by the compression of the gases and vapours, and to prevent secondary action or dissociation from taking place with the waste of energy involved—thereby "economizing and hastening the process of distilling and the production of the vapours."

This method of distilling is said to produce a superior variety of coke. As a result of the comparatively low temperatures at which the distillation is carried on (no combustion being permitted to take place) no "coking" of the coal in the ordinary technical sense of the term ensues; and the residual coking having been effected below incandescence, "the product differs from all cokes heretofore produced in its properties." It "approximates closely to charcoal in its softness, porosity, ease of ignition, and free-burning qualities." By virtue of these peculiarities, it is, moreover, much more readily and rapidly acted on and dissolved by highly-heated steam, in the manufacture from it of water gas for direct fuel uses, or for a medium to take up the vapours of hydrocarbons in making water gas for heating and illuminating ses.

Apparatus constructed according to this invention consists of an exterior structure in which are embraced the fire-chambers and heat-flues, fuel-magazines, a compartment between the fire-chambers and the heat-flues, and a trough below the compartment into which the vapours descend on their way to a pipe leading to an exhauster, by which they are drawn out and driven to the condenser. The apparatus also comprises a casing that fits snugly into the compartment, and in which the material to be distilled is placed, and which is adapted to be readily placed in, or withdrawn from, the compartment.

Fig. 1 is a vertical cross section of the apparatus taken through the centre. Fig. 2 is a horizontal section. Fig. 3 is a sectional side elevation (on a reduced scale). Fig. 4 is a longitudinal vertical section of the casing which forms the receptacle for the material,

The exterior structure is preferably built of plate steel or iron, and at the sides, near the bottom, there are fire-chambers A between the exterior walls and the walls of the compartment B. The fire-chambers are lined with fire-brick and provided with grate-bars. The rear wall-plates are joined to the side walls so as to close completely the chambers at the rear; and at the front they are closed air-tight by flanged plates let into the front of the chambers and secured by bolts. Below the fire-chamber are ash-pits C, and between them, and directly under the compartment B, there is a trough E (having a vapour exit at the rear) to which is fastened an exhaust-pipe that leads into the casing of a rotary exhaust-fan shown in fig. 3.

Above the fire-chambers are fuel-magazines H, having at the top exterior water-troughs to receive the rims of covers forming water seals. Between the walls of the compartment B and the walls of the fuel-magazines, there are vertical heat-flues L leading from the fire-chambers.

The compartment B is closed at the top by a cover riveted to the walls of the magazines, and a short distance from the cover the walls are provided with perforations. The bottom plates are furnished with valve-seats in the valve-chambers M. Valves D in the chambers have their rods passed through the tops, so that they can be opened and closed either by hand or by mechanical means. Just under the cover in the back walls of the heat-flues there are draught openings F, from each of which pipes lead to the stack (not shown).

Longitudinally of the cover of the casing there is a vertical slot G between upward extensions of the cover, which is open at the front. The tops of the extensions are turned over at right angles so as to form flanges on which a plate is luted with clay, and fastened to form an air-tight cover for the groove when distilling is going on. Hooks are passed down through the slot G into the compartment B, so as to lift and carry the casing K when it is moved in and out of the compartment. The casing fits into the compartment easily—only space enough being left between to allow for expansion, so that as much as possible of the heat from the flues will radiate through the walls and reach the contents. The casing is provided with longitudinal brackets on which brackets trays are placed (but not fastened, so that they can be slid in and out of the casing at the front or open end). The trays are not so long as the casing, and, when filled with the material to be distilled, they are staggered, so that spaces are left between their alternate ends and the end walls of the casing—a zig-zag passage being thus formed. The heated products of combustion drawn through the casing are thus compelled to traverse the entire length of the trays and their contents twice—first over the top, and then under the bottom.

The operation of the apparatus in the distillation of the coals is as follows: The casing rests when in the compartment on the base-frame shown in figs. 1 and 3. To move it out of the compartment for the purpose of putting the material on the trays, it is lifted by means of the pulley until it is suspended just above the base-frame, and (the door of the compartment having been previously removed) the casing is run out of the compartment by means of the trolley. The trays are then filled with coal; and the trays are carefully adjusted so that a zig-zag passage is formed through the casing. The door of the casing is then put in place to close the front, and the casing then run back into the compartment and lowered until it rests on the base-frame. The fires are then started up and the dampers in the pipes (only one of these pipes and dampers being shown) leading to the stack opened for a short time to quicken the fire. When the temperature in the apparatus reaches (say) 750° Fahr.—or below red heat or incandescence, as indicated by the pyrometer P—the dampers are closed, and the exhauster is driven at high speed. The effect of this is to draw the hot, gaseous, neutral (or deoxidized) products of combustion up through the heat flues; then through the perforations into the valve-chambers; and then downward into the casing past the valves D through the zig-zag passage, through the casing K, as indicated by the arrows. In passing downward, following the passage, it necessarily passes over the top of the coal on the trays to the spaces between them and the end walls of the casing; and, descending through these spaces, it passes in the opposite direction under the bottoms of the trays. Thus the coal in each tray is exposed to the rapidly moving currents of the hot products of combustion; and "the action of the heat in drawing out the oils is continuous and rapid. The temperature not being sufficiently high to dissociate the initial products, tar, naphthalene, benzols, &c., are not developed, large quantities of paraffins are produced, and the residual coke is hard, porous, free burning, and practically quite devoid of volatile matter—these qualities assimilating it more nearly to charcoal than to the coke produced by high temperatures in coke-ovens."

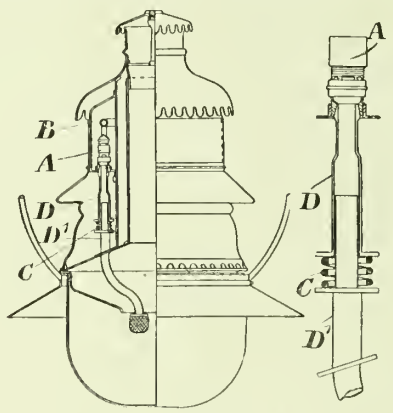
The temperature of the products of combustion is regulated by the valves D, by means of which it can be maintained between 700° and 800° Fahr., or below red heat or incandescence, at which point the desired results are obtained. By means of these valves, "the currents of heated gases or vapours are managed in such ways as to accomplish all the chemical objects aimed at. The currents of the products of combustion containing carbonic oxide are made to pass through the decomposing coal from above downward; thus sweeping the heavy vapours away from the heat as rapidly as possible, and preventing secondary action and dissociation. Hence, the total absence of tar, naphthalene, and benzol, and the unprecedented amount of phenols that are formed. Hence, also, the short duration of the operation, compared to that of the white-hot gas-retort, in which the heat is largely expended in the work of dissociation of the first products."

Gas Lamps and Burners.

HELPS, GEORGE, of Nuneaton.

No. 13,813; June 16, 1906.

In one method of construction of this lamp, the air-cones A and nipples of the inverted burners are contained in an annular-shaped box B secured to the chimney or body of the lamp in such a manner that it, together with the air cone and nipples, can be readily removed from the lamp without the tubes of burners. The box is provided with air inlets and means of access for adjusting the air to each burner, and rests on a supporting ring secured to the chimney.



Helps's Inverted Gas-Lamp.

The casing of the lamp below the chimney projects in such a form that it acts as a reflector and so that the burner-tubes D D¹, consisting of two tubes, one sliding or screwing over the other and held in position by springs C or nuts, may be fixed in between the annular box and the casing. Shoulders, flanges, or projections are made on the burner-tube to regulate the distance that the nozzle end of burner-tubes project through holes in the casing. They also form a close joint between any air on the outside of the lamp casing and the products of combustion inside.

Water-Gas Producers.

CLARK, W.; a communication from the Dellwik-Fleischer Wassergas Gesellschaft, of Frankfort-on-the-Main.

No. 18,256; Aug. 14, 1906.

This invention more especially relates to producers working on the Dellwik system, and which have hitherto been worked solely with compressed air. The proposal is, however, to work them with "suction air;" plant being provided with a charging device in the form of a coal-feed hopper erected directly upon the producer, and the gas-main leading from the charging device to a fan. A bye-pass pipe for the fan is provided, for the purpose of heating-up and keeping the producer hot while at rest.

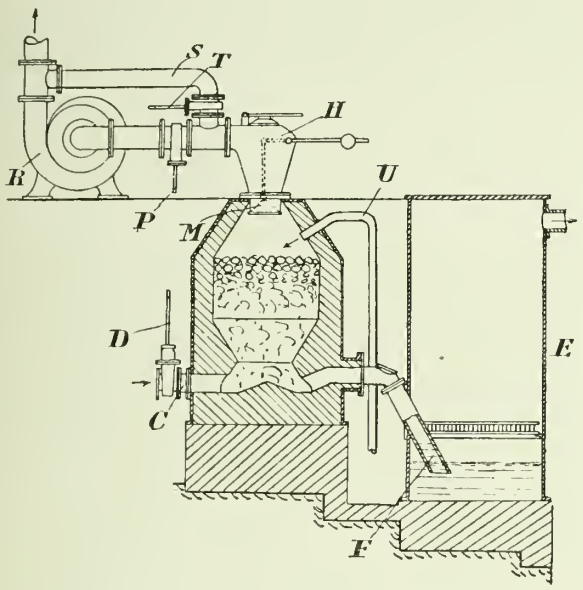
The grate hitherto usually employed for such producers is dispensed with, so that the producer charge rests immediately on the producer bottom, or rather the resulting layer of ashes and slag.

The steam-pipe opens into the producer at the top; while the gas-pipe is led off from the bottom of the producer (and not from below the fire-bars as heretofore), and discharges into a scrubber arranged at a lower level. Here a water seal is provided, so that the issuing gas is able to pass into the scrubber; while the indrawing of the air when the producer is being blown-up for heating only results in a rise of the scrubber water into the gas-pipe.

As shown next page, the blast enters through the pipe C fitted with a slide valve D, while communication with the scrubber E (at a lower level) is established by the pipe F, which extends below the level of the water into the scrubber. H is the coal-feed hopper, which is emptied by depressing the cone M by the lever shown. The hopper has connected to it the pipe provided with a sheet-metal slide-valve P and connected to the fan R. S is a bye-pass pipe fitted with a sheet-metal slide-valve T, which has a large opening corresponding to the cross-sectional area of the pipe, and also a very small opening. U is the steam-pipe.

On starting, the slide P is closed and the slide T is opened wide, in order that the resulting gases may be able to escape without hindrance through the bye-pass pipe S into the chimney. The cone M is lowered,

and the blast slide D is opened according to requirements. Later on, in heating up (suction), the blast slide D is opened completely, and, of course, the slide P also; and the slide T having been closed, the fan R is started. During working, the slide P is permanently open and the slide T is always closed. After sufficient heating up, the fan is stopped, and the generation of gas commences. The slide D and the cone M are closed, and steam is admitted through the pipe U. The gas escapes at the bottom, through the pipe F, into the scrubber. During the "slagging" operation, the slide valve P is entirely closed, and the slide valve T is moved into a position in which the resulting waste gases can escape only through its very small opening. The same position is chosen when the producer is stopped over night, but when it is desired to maintain the heat.



A Dellwik-Fleischer "Suction-Air" Water-Gas Plant.

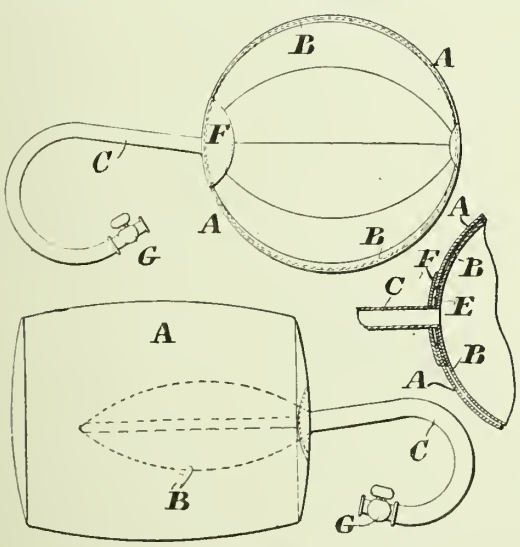
The patentees remark: In addition to the well-known advantages of the absence of a grate, the light work of slagging, the generation of good water gas containing little carbonic acid, which always issues at the hottest point, there may be further mentioned that no loss of steam through badly-shutting gas-valves can occur, because there are none, and that the danger of poisoning from water gas passing out at the uptake is obviated, as, even if the feed hopper should be closed imperfectly, only steam (and never water gas) can escape outwards, because the gas is led away at the bottom at F, and the upper space of the producer is filled only with steam during gasification. Similarly, during the heating blow, blow-gases cannot escape at the top into the space, as has been the case hitherto, because, by reason of the suction-working, if there are any leaky joints and covers, although air may be sucked in, gas can never pass out.

Gas-Main Bags.

Bugden, T., Martyn, H. C., and Arbon, A., of Goswell Road, E.C.

No. 20,301; Sept. 12, 1906.

This gas-main bag is composed of two bags—one an elastic bag in flexible connection with a tube for inflation, and the other an outer flexible bag loosely surrounding the elastic bag and connected to it by a flexible connection.



Bugden, Martyn, and Arbon's Gas-Main Bag.

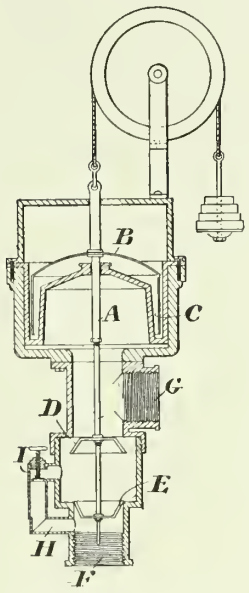
Two forms of the bag are shown. A is the outer bag—of spherical, cylindrical, or other suitable form—made of non-elastic flexible material. When made of rubber cloth, it is preferred to have this vulcanized, in order that it may better resist the "main liquor" or other injurious deposits. B shows the inner bag—of rubber, skin, or other flexible elastic material—in flexible connection with a tube C. Over the end of the tube which passes through the bag is secured, by adhesive material, a disc E, of rubber, so as to come inside the bag A. This disc E may be cemented directly on to the inner bag—the outer surface of the disc being adhesive. The bag A extends a short distance over the disc. Another disc F, of rubber cloth coated on its inner surface with adhesive material, is then passed over the tube C. When the two discs are pressed together, they become cemented to one another except at their outer edges, where the bag A comes in between, as shown in the section. The outer edge of the disc F is then sewn to the bag A, thus making a complete joint.

Controlling the Supply of Atmospheric Air to Purifiers.

Stott, J., of Oldham, and Saville, G. E., of Penmaenmawr.

No. 21,581; Sept. 29, 1906.

This apparatus for controlling the supply of air to purifiers for the purpose of revivifying the oxide of iron *in situ*, while at the same time acting as a back-pressure or safety valve, and preventing any back flow of gas, is shown as consisting of a governor, either mercurial or water sealed, or actuated by a flexible diaphragm; the rod A of the governor carrying the bell float B, which dips in the mercury trough C, and also two valves D E, arranged in opposite directions. The inlet F is to the outlet of a meter, the inlet of which is open to the atmosphere. The outlet G is connected to the main leading from the condensers to the exhauster.



Stott and Saville's Air-Regulator for Purifiers.

The effect of oscillation of pressure in the gas-main caused by the motion of the exhauster is that at the moment the draught or suction caused by the exhauster is the most, it pumps in atmospheric air through the apparatus. The valve E, actuated by the mercurially sealed float B or gasholder, almost, or entirely, closes the inlet F in proportion to the pull of the exhauster. At that time the air is either partially or wholly passing through an orifice or bye-pass H, the outlet of which is controlled by a regulating screw-valve I. If at any time the speed of the exhauster should be too slow, or the exhauster accidentally stop (either of which would cause a pressure of gas within the mains), the safety valve D closes the outlet and prevents any back flow of gas.

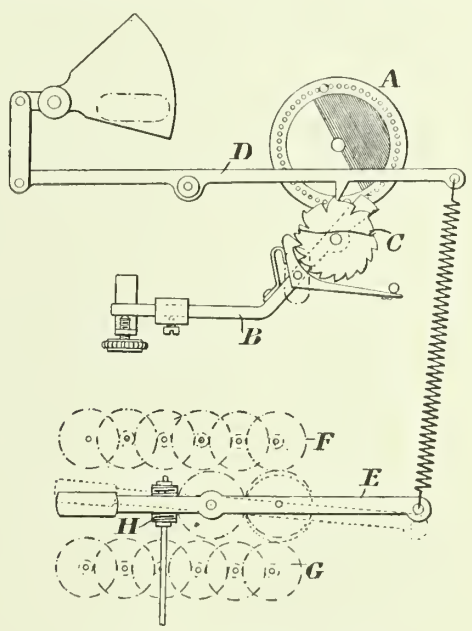
The gasholder or float B, together with the valves, are counterbalanced by weights suspended on a chain working over a pulley connected to the rod A; and the weights are so adjusted that the holder or float, with the rod and valve, are slightly the lightest weight. The effect is that the valve D closes a little in advance of any pressure within the holder or float.

Meters for the Supply of Gas at Two Different Tariffs.

Hardingham, G. G. M.; a communication from Landis and Gyr, (formerly Theiler and Co.), of Zug, Switzerland.

No. 24,197; Oct. 30, 1906.

This invention relates to meters applicable for the supply of gas or electricity where the supply is effected at two different rates at different periods of the twenty-four hours.



Landis and Gyr's Two-Tariff Meter.

As shown, the clockwork is employed to rotate (once in twenty-four hours) a disc A furnished with holes about its periphery. The disc is marked to indicate the hours between midnight and noon, and between noon and midnight; and pins are inserted in the holes in the disc in the positions corresponding with the hours at which it is desired to change the charge for the supply from the one tariff to the other. For

this purpose, the pins upon the disc engage one arm of a pivotally-mounted inclined and counter-weighted lever B, furnished with a spring-pawl which engages a ratchet attached to the spindle of a wheel C, the periphery of which is formed with indentations alternating with projections. This wheel serves to impart a to-and-fro movement to a pivotally-mounted arm D formed with a lateral projection, which engages and disengages the indentations on the wheel C when the latter is rotated. An adjustable stop is provided to regulate the movement of the lever B and the rotation of the wheel C; while rotation of the wheel in the opposite direction is prevented by the indentations when the arm is in engagement with it. When the arm D, however, is supported upon the periphery of the wheel C, it engages the projections upon the latter and prevents the wheel rotating. One extremity of the arm is connected (preferably by a spring) to a lever E pivotally-mounted between two counting mechanisms F and G. With the latter a pinion mounted on the lever E is adapted to engage; the pinion being rotated by worm gearing H mounted upon a shaft driven by the motor of the meter. When the lateral projection upon the arm D enters an indentation in the wheel C, the pinion is brought into engagement with the counting mechanism G corresponding to the one tariff; while, when the lateral projection is not so engaged, the pinion is in gear with the mechanism F corresponding with the other tariff.

For indicating which particular tariff is for the time being in operation, the arm D may be connected to a quadrant arranged opposite an opening in the clock dial and marked to correspond with the respective tariffs.

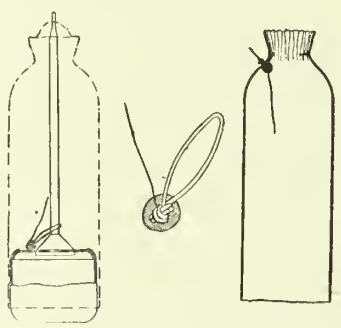
Igniters for Incandescent Gas-Mantles.

HOFMANN, R., of Frankenberg, Saxony.

No. 27,079; Nov. 28, 1906.

Gas-igniters of the kind here referred to have been made by soaking meerschaum with a concentrated solution of platinum, or by pressing platinum in the form of platinum black. The first kind require a considerable, and therefore expensive, mechanical working; while igniters of platinum black contain much platinum when compared with their acting surface, and are liable to mechanical injury.

The igniter of "catalytically acting material"—such as platinum in the form of platinum black—is arranged round a knot of refractory non-catalytic material such as asbestos, which latter thus constitutes the core of the igniter proper, and has no influence upon the catalytic action of the latter. The knot is dipped into (say) a mixture of platinum black, or the latter is applied by a brush to the knot.



Hofmann's Gas-Mantle Igniter.

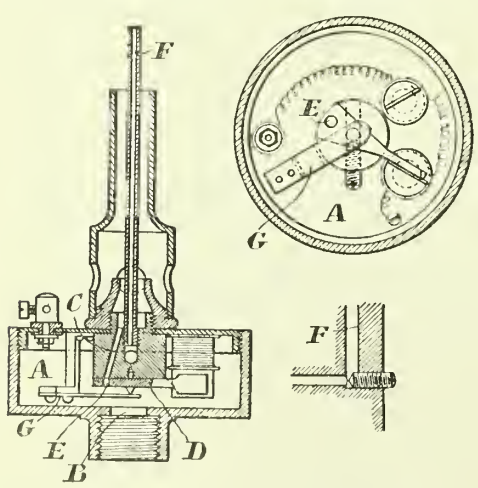
As shown, a thin thread of asbestos is knotted into a tangle at its ends and a wire of platinum simultaneously attached to the knot. The knot, after the free ends of the asbestos thread are cut off, is dipped into a mixture of platinum black and nitrate of aluminium; and then the igniter is dried and burnt off. Two different ways of attaching the igniter to the burner and the incandescent mantle respectively are shown.

Lighting Gas from a Distance.

ABEL, K., and PERVESLOR, F., of Vienna.

No. 28,796; Dec. 17, 1906.

This invention relates to an electro-magnetically operated device for lighting gas from a distance—being an armature mounted by means of a spring so as to move over the lower surface of an insertion piece, which



Abel and Perveslor's Automatic Gas-Lighter.

forms the termination of the burner-tube. This member has a passage for the gas; and the armature is provided with a perforation which in one of its end positions registers with the perforation in the insertion piece. The position of the armature is controlled by an electro-magnet, between the two poles of which the armature is adapted to swing. The insertion piece is arranged to project downwards below the end of the burner-tube, and a passage is formed for the supply of gas to the pilot-flame tube through the insertion piece, so that the tube may project straight up through the centre of the burner-tube.

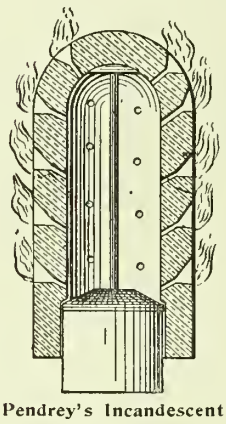
The chamber A communicates with the gas-supply pipe through an aperature B and with the burner-tube through a passage C, governed by an armature D adapted to swing between the poles of an electro-magnet. The armature has an aperture E, which communicates with the passage C. There is a plug attached to the cover of the chamber A and projecting downwards into the chamber. The pilot-flame tube F screwed into this insertion is constantly in communication with the chamber A by means of a cross passage. The regulation of the quantity of gas reaching the tube F is effected by a screw G. The spring presses the armature against its seating and secures its resting gas-tightly thereon, as soon as, by stopping the admission of gas, the pressure on the armature ceases.

Incandescent Mantle for Heating Purposes.

PENDREY, J. E., of Southall.

No. 2737; Feb. 4, 1907.

This "incandescent mantle for heating purposes" is composed of asbestos and fire-clay, or other refractory heat-radiating material, supported on an ordinary atmospheric burner in the same manner as an incandescent mantle for lighting purposes. The hollow mass of refractory material is closed at the top, where it rests on the head of the prop, and is laterally perforated for the escape of gas that, when lighted, raises the mantle to a high temperature.



Pendrey's Incandescent Heating Mantle.

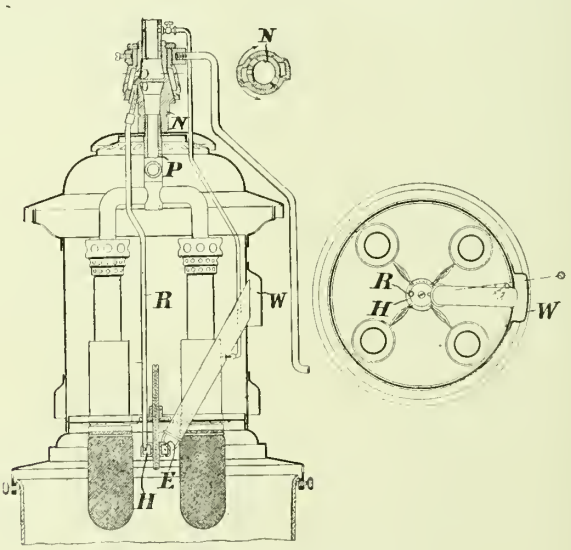
The mantle is provided with lateral perforations, preferably inclined upwards, the inner ends of which are of comparatively small diameter, while their outer ends are flared as shown. These outlets for the gaseous mixture are distributed over the lateral surface of the mantle, preferably at intervals of about $\frac{1}{4}$ inch; but no perforations are formed in the top of the mantle where it rests on the prop. The gaseous mixture is said to burn with "a blue heating flame and intensely heats the outer surface of the mantle, from which heat is radiated to the apartment."

Inverted Incandescent Gas-Lamps.

GRAETZ, A. & M., of Berlin.

No. 3403; Feb. 11, 1907. Date claimed under International Convention, Nov. 3, 1906.

The patentees describe a method of lighting inverted lamps characterized by a device being used in which, owing to the striking-back of a flame, the ignition or lighting flames, and through these, the proper burner flames, are lighted. The striking-back of the flame in the ignition burner pipe is utilized for transporting the flame of the lamp lighter from a point arranged on the outer casing of the lamp (and visible from below) inwards to the proper burner openings, and thus for producing an ignition flame at a point inaccessible from the outside.



Graetz Inverted Lamp Igniter.

The casing of the lamp is closed against the atmosphere; and the mantles are (directed downwards) connected in the usual way to the burner pipes. In the centre of the lamp is a small gas-collecting casing H, provided with four burner openings and supplied with gas through the pipe R when the rotatable casing of the cock N is in the correct position to supply gas to the ignition flame pipe; the gas escaping from the casing H, through the opening E, into an ignition burner pipe, which opens into the hood W outside the casing of the lamp. If an ignition device be now applied to the upper opening of the ignition pipe, a flame is produced, which at once strikes back and produces a flame at the opening E—the flame lighting the ignition flames for the mantles, which are arranged close by and which escape from the openings. These small gas-flames are directed against the mantles, and when the casing of the gas-cock is rotated further relatively to the

plug, gas passes into the supply pipe P for the incandescent burners of the lamp, and the small auxiliary flames at H ignite the gas jets escaping from the burners. After this ignition has been effected, the rotatable gas-cock is brought into the position in which the gas supply to the incandescent burners is maintained; but the supply to the ignition flame pipe R is cut off.

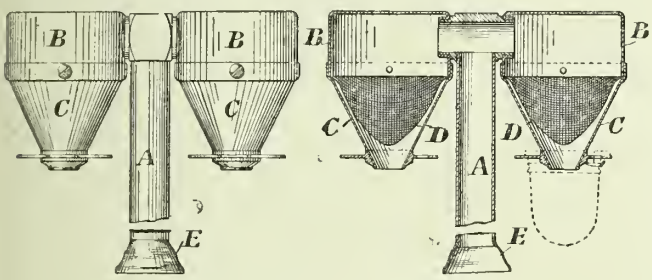
While in the arrangement described the ignition of the lamp from the outside is effected by means of a flame brought against the lamp casing, the essential point of the invention is that the ignition of the main flame should be preceded by an ignition of an ignition burner or similar device, which at once strikes back, and then, in its turn, ignites the real igniting flames.

Incandescent Burners.

SCHOMANN, B., of Great James Street, W.C.

No. 8897; April 17, 1907.

These incandescent burners (especially when used for outdoor lighting) can be arranged in much closer proximity to the burner-tube than heretofore without incurring the risk of overheating of the tube and consequent back-lighting of the gas. This is effected by arranging, close beside the upper end of the burner-tube, and in communication with it, mixing-chambers each of cylindrical form above, with a downward extension in the form of a conical frustum within which is a wire gauze screen of conoidal form, and at the lower end of which is the gas outlet, with an annular mantle support of the usual type for inverted mantles.



Bruno Schomann's Inverted Mantles.

In the engraving, the vertical tube burner A is in communication at its upper end, through a union, with a pair of mixing-chambers, each composed of a cylindical portion B and a conical portion C, within which is the wire gauze screen D (of conoidal form) to prevent flashing-back of the flame. Around the outlet orifice is secured the usual annular support for the mantle. In the lower end of the tube A air inlets may be formed provided with means for regulating the air supply. Preferably, however, the tube is supported by means of a flange E on the usual bunsen burner; the flange being interchangeable to adapt the tube to burners of various sizes.

APPLICATIONS FOR LETTERS PATENT.

14,522.—DOLAN, E. J., and TRACY, M. J., "Acetylene-burners." June 24.

14,523.—STEWARD, C. S., and LOWRY, W. T., "Acetylene-burners." June 24.

14,539.—BROMHAM, F. J. H., "Gas-producing apparatus." June 24.

14,551.—COWPER-SMITH, A. T., "Lighting and extinguishing lamps." June 24.

14,552.—COWPER-COLES, S. O., "Generation of power." June 24.

14,553.—COWPER-COLES, S. O., "Smokeless fuel." June 24.

14,571.—VAN PRAAG, D. J., "Acetylene-burner." June 25.

14,650.—LOMAS, T. P., "Gas cooking-stoves." June 25.

14,678.—COWPER-COLES, S. O., "Smokeless fuel." June 25.

14,683.—THORN, A. W., "Acetylene apparatus." June 25.

14,714.—WHITE, W. C., "Treatment and distillation of coal for the prevention of smoke and too rapid combustion." June 26.

14,774.—CROWTHER, A., "Flexible gas and water piping." June 27.

14,815.—BOSTOCK, F. H., "Prepaid meters." June 27.

14,879.—WOODROFFE, J. H., "Inverted lighting." June 29.

14,884.—BEAL, W., "Gas-pendants." June 29.

14,928.—ROESSLER, A. C., "Incandescent lighting." June 29.

14,956.—JENKINS, D. R., "Gas-furnaces." June 29.

15,035.—BIENECK, A., "Supporting chimneys of inverted incandescent gas-lamps." June 29.

15,047.—AKTIEBOLAGET GASACCUMULATOR, "Lighting and extinguishing gas-flames from a distant point." June 29.

15,049.—COWPER-COLES, S. O., "Smokeless fuel." June 29.

15,053.—WOODALL, H. W., and DUCKHAM, A. M'D., "Discharging vertical or substantially vertical retorts." June 29.

Pontefract Corporation Gas-Works Purchase.—The purchase of the Pontefract Gas-Works by the Corporation, in accordance with the terms of the Act of Parliament passed last year, was completed on Monday last week, when the purchase-money and other expenses were handed over. The price fixed by the Umpire (Sir Hugh Owen) was £69,600. At the meeting of the Town Council on Wednesday, authority was given to the Gas Committee to raise the price of gas if found necessary.

Accident at the Newark Gas-Works.—Last Sunday week, six men were overcome by gas at the Newark Gas-Works, but fortunately all recovered under medical attention. It seems that a valve connected with one of the holders had become stuck; and it was resolved to remove it on the Sunday morning for repair. The six men were told off for this purpose; but for some reason or another the bladders used to stop the pipes while the work was in progress burst, and all the men were more or less affected by the rapid escape of gas before they could get out of the inspection pit.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Distribution of Gas at Increased Pressure.

SIR,—I have been away for a week; and on my return I notice by the report in the "JOURNAL" for the 25th ult., that Mr. Charles Carpenter, in winding up the discussion on his paper on the above subject, read at the Engineering Conference in London, made an allusion, somewhat short-sightedly and what was also evidently intended to be slightingly, to the "Golden Rule" given in the "Handbook for Gas Engineers and Managers," relating to pressure in the mains.

Now, I have never been opposed to maintaining as high a gas pressure as may be necessary in any given case. I should be wanting in common sense otherwise. Nay, I am in favour of high pressure—amounting to pounds on the square inch—on trunk mains, wherever it can be applied with advantage and under proper conditions. In some of our largest gas undertakings, this has been done for years past, and to-day is a growing necessity—not, however, during the whole of the 24 hours, as advocated by Mr. Carpenter.

The vision of some critics is so restricted that they have difficulty in seeing beyond their own noses. What may be right for some—and especially for the few large concerns—is not applicable to the vast number, amounting to hundreds, of smaller works. A text-book, to be of use to those who need its assistance, must take account of the conditions generally prevailing. To most of these hundreds of gas-works throughout the country, the maintaining of high pressures during the 24 hours would simply mean disaster. And where is the need of it during all hours of the day and night?

Mr. Carpenter says that he used to read the "Golden Rules" in the text-book "when he was a boy." I am very pleased to hear this personal testimony (it is not every day that what one has written is recognized); and I believe that if he duly attended to the advice they give, and acted accordingly, he was a very intelligent and good boy, and later on grew to be a successful manager. Perhaps I am not claiming too much for the "Rules" in expressing the hope that, owing to their being impressed on his mind from boybood, and by giving attention to what they inculcate, they may have contributed (in some slight degree, of course) to his attaining his present high position in the gas industry.

Manchester, July 5, 1907. THOMAS NEWBIGGING.

Mr. Tooms's Gas Institution Paper.

SIR,—With reference to Mr. Lyne's communication in your last issue, it is quite evident that he has no recollection of what he did say, or of what actually took place during the discussion on my paper at the Institution meeting. I am sure it is within the recollection of all present, with one exception, that I interposed no single remark during the discussion, and made no attempt to reply until called upon by the President. If Mr. Lyne had advanced any criticism at the meeting in the intelligible manner he has now amended it through your columns, it would have been possible, and I would have tried, to answer it. Rightly or wrongly, I considered I was doing Mr. Lyne a kindness by ignoring altogether the few wild remarks I was able to catch.

That the price of gas has a strong influence in increasing consumption cannot be disputed; and in my paper I made no attempt to dispute it. But I reiterate, up-to-date, efficient, outdoor service to customers has a far greater influence. And it is a policy which is a most effective one for any administration to employ, to reduce the price of gas. Of course, an undertaking conducting its outdoor service on the lines advocated by me, and also selling gas at a low rate, should make more progress than a similarly conducted undertaking burdened with a high price per 1000 cubic feet; but I know of very few cheap-gas undertakings, and certainly none in the South East of Ireland, where the outdoor service, so called, is worth mentioning. Possibly it is found that cheap gas may be left to sell itself, on the take it or leave it principle.

Referring to Mr. Lyne's figures relative to the make of gas per head of population of the different towns quoted by him—and this is the gist of the whole of his letter—accepting the figures as correct, if they prove anything at all, it is the fallacy of attempting to compare progress in different towns by such a method. Unfortunately for Mr. Lyne's argument, they show that low selling price of gas has no effect on make per head of the population. Cork and Dublin, with identical prices, show a difference of 20 per cent. in the make of gas per head; while Bangor, a small town of about 6000 inhabitants, selling gas at over 50 per cent. higher price than Belfast and 27 per cent. higher than Wexford, has a make per head of the population almost as large as Belfast, and 35 per cent. higher than Wexford. How can Mr. Lyne reconcile these facts from his own figures with the conclusions he draws? As to inferences to be drawn from the paper, provided they are logically drawn from it, Mr. Lyne or anyone else may draw what inference he pleases. If the cap fits, I can only say "wear it."

Mr. Lyne admits he has no knowledge of what has been done in the other towns he evinces such an interest in. Presumably he has some knowledge of what has been done in Wexford; and I would recommend him, when next rushing into print, to confine his remarks to matters of which he has some elementary knowledge. I cannot do better than compare Wexford's progress (taken from directory returns supplied by Mr. Lyne) with that at Waterford. Admittedly Wexford, with its huge engineering shops and many other factories, is one of the most progressive and prosperous towns in the whole of Ireland.

From 1901 and 1907 Directories.

Price of gas: Wexford, 2s. 10d. to 2s. 9d.; Waterford, 4s. 3d. to 3s. 9d.
Wexford, make of gas increased from 36 millions to 41 millions, or 5 millions.
Waterford, ,, ,, ,, ,, 65 ,, 81 ,, 16 ,,
Wexford, slot meters ,, ,, 50 to 80, or by 30 meters.
Waterford, ,, ,, ,, ,, 200 ,, 1056 ,, 856 ,,
Wexford, cookers on hire increased *nil* to *nil*, or by *nil*.
Waterford, ,, ,, ,, ,, 120 ,, 1058 ,, 938 cookers.

The significance of these statistics is that if Wexford, instead of relying solely on cheap gas, had conducted the outdoor department on modern up-to-date lines, as advocated by me, they would not now be crying out that the gas consumption was at a standstill. It is not, I hope, too late for them to mend their ways.

In Waterford the fittings turnover, exclusive of stoves on hire or goods supplied outside the city, amounted during the past five years to £8000. During the same period 103,640 mantles and 8317 incandescent burners were disposed of by the Waterford Gas Company, along with 45,000 mantles and 4100 incandescent burners supplied during the same time to other gas-works. Ten years ago, the minimum weekly consumption of gas was to the maximum weekly consumption 27 per cent.; in 1906 it had increased to 38 per cent.

When, nearly twelve months ago, invited by the President to contribute a paper to the proceedings, I acceded to his request, believing that such a paper as I read would be of interest to a large number of the members representing small undertakings. The number of letters I have received since the paper was published, asking for detailed information, is sufficient assurance, if any were needed, as to the merits of the subject dealt with; and I shall be more than repaid for any trouble involved in the preparation of the paper if it should prove instructive to Mr. Lyne.

Waterford, July 4, 1907. JOHN G. TOOMS.

Self-Intensifying Gas-Lamps.

SIR,—In the very interesting paper read by Mr. H. E. Copp, at the recent meeting of the Institution of Gas Engineers, we notice that he says, in connection with the self-intensifying system of gas lighting, that—"depending, as it does, entirely on the length of chimney for its efficiency," &c.—certain defects come in under this system. Mr. Copp is evidently unaware of the existence of our self-intensifying lamp, which does not depend on an unsightly long chimney, but on the particular method employed to supply air to the burner, and also on the way air is projected on the mantle. By our plan, the evils he mentions are entirely avoided—especially the wear and tear of mantles.

Incidentally, our plan brought about an improvement that has proved very valuable—viz., that dust, smoke, and steam in the air have great difficulty in getting into the bunsen part of the burner, and so causing mischief to the burner and mantle. Much success in this direction has attended the use of our lamps, which have been fitted in many places where dust-proof bunsen burners were essential and where ordinary incandescents were not a success.

Charles Street, E.C., July 6, 1907. A. E. PODMORE AND CO.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills reported, with amendments: Annfield Plain and District Gas Bill, Bude Gas Bill, Gas and Water Orders Confirmation Bill (No. 2), Leeds Corporation Bill.

Bills read the third time and passed: Brighouse Corporation Bill, Broadstairs and St. Peter's Urban District Water Bill, Portishead District Water Bill.

Bills Royal Assented: Basingstoke Gas Bill, Birmingham Corporation Water Bill, Boston Spa Gas Bill, Brockenhurst Gas Bill, Falmouth Gas Bill, Gas Companies (Removal of Sulphur Restrictions) Bill, Grays and Tilbury Gas Bill, Keswick Urban District Council (Water) Bill, Maidstone Gas Bill, Mitcham and Wimbledon District Gas Bill, Newquay and District Water Bill, St. Neots Urban District Council Bill, Shanklin Gas Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Broadstairs and St. Peter's Urban District Water Bill, Portishead District Water Bill.

Lords Bills read a second time and committed: Birkenhead Corporation Water Bill, Gas and Water Orders Confirmation Bill (No. 1).

Lords Bills reported, with amendments: Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Board Bill, Coventry Corporation Bill, Pontypridd Urban District Council Bill, Sheffield Corporation Bill, Tees Valley Water (Consolidation) Bill.

Lords Bills read the third time and passed: Southend Water Bill, Southport, Birkdale, and West Lancashire Water Board Bill.

Exports of Gas Coal.

In answer to a question by Mr. Fell, the President of the Board of Trade (Mr. Lloyd-George) presented a statement showing the quantity of coal exported from this country for each of the months since the export duty was abolished, compared with the corresponding months of the previous year. The figures furnished were for anthracite and for steam, gas, household, and other sorts of coal; but we give only those for gas coal.

	1905-6.		1906-7.			1906.		1907.
Nov.	590,832	..	714,531	March	..	77,837	..	116,638
Dec.	570,721	..	628,543	April	..	678,605	..	821,674
Jan.	90,685	..	113,511	May	..	111,864	..	147,485
Feb.	551,840	..	669,407					

KINGSTON-UPON-HULL CORPORATION BILL.

House of Lords Committee.—Thursday, July 4.

(*Before the Earl of* DONOUGHMORE, *Chairman; the Earl of* ABINGDON, *Lord* INCHIQUIN, *Earl* KENMORE, *and Lord* SUFFIELD.)

The object of this Bill is (among other things) to authorize the Corporation to acquire the undertaking of the East Hull Gas Company.

The Hon. J. D. FITZGERALD, K.C., Mr. RAM, K.C, and Mr. JEEVES appeared for the promoters (with Messrs. Sharpe and Co., as Agents). The Bill was opposed by the East Hull Gas Company, who were represented by Mr. BALFOUR BROWNE, K.C., Mr. HONORATUS LLOYD, K.C., and Mr. PADDON; while Mr. MOON, K.C., and Mr. LAWRENCE appeared for the North-Eastern Railway Company.

Mr. FITZGERALD, in opening the case for the promoters, remarked that the Bill was divided into two portions. The only part opposed was that relating to gas; and this was the only part that he proposed to deal with. Until recently the City of Hull was supplied with gas by three Companies. The old City of Hull was until recently supplied by the Kingston-upon-Hull Gas Company. In 1897, the Corporation obtained an Act under which they acquired the undertaking of this Company at an agreed price of £92,500. The transfer took place in 1898; and since then they had been supplying gas within the City. Gas was supplied by the old Company at 3s. per 1000 cubic feet; but the Corporation had been able to reduce it to 2s. 6d. The works of the old Company were most inconveniently situated in the centre of the old town of Hull, without any facilities for getting coal cheaply. It was always the intention of the Corporation to dispense with these works, and use them for the improvement of the town. The Act of 1898 enabled them to get a supply of gas in bulk from either of the adjoining Companies; and arrangements were made with the British Gas Company by which that Company supplied them in bulk at the price of 1s. 6d. per 1000 cubic feet—they distributing the gas and bearing the expense of distribution and managing the entire gas supply. The whole result had been very satisfactory. It had been for many years the intention of the Corporation also to acquire the undertaking of the East Hull Gas Company. The opportunity came last session. Up to that time, the East Hull Company was known as the Sutton, Southcoates, and Drypool Gas Company, when they changed their name. Last session their capital became exhausted, and they were obliged to come to Parliament after a lapse of forty years. The Corporation opposed the Bill upon the ground that they desired to take over the undertaking, and that no further powers ought to be conferred upon the Company, except on the basis that the Bill was to be heard this session and not to be prejudiced. The Bill was heard before a Committee of the other House, who decided that they were prepared to pass the preamble on two conditions—one being that a purchase clause, on the lines of the Merthyr Tydfil clause, should be inserted. The main object of the Bill of last session was to authorize the Company to raise additional money; the whole of their original capital having been expended. The East Hull Gas Company was originally started as a joint-stock undertaking, or non-statutory Company, as long ago as 1846. In 1867, they were incorporated as a statutory concern. At that time the capital was £24,000; and the whole of this had now been spent. By the Act of 1867, the Company were authorized to raise a further sum, by way of new capital, of £76,000; making a total of £100,000 in all, with a maximum dividend of 7½ per cent. The Company had always paid this maximum dividend from the year 1867 down to the present time. They were authorized under their Act to issue their new capital under the auction clauses, which were made compulsory by a Standing Order in both Houses of Parliament about 30 years ago. Prior to that time, it had been the custom, both of gas and water companies, when their stock was at a high premium, to issue new stock to their shareholders at par. In many gas companies, the £100 stock stood at £150 or £160, and even as much as £200; and they issued their new stock as required at par to the existing shareholders, who received not merely the maximum dividend which the stock was entitled to, but also a very large bonus in the shape of 50 or 60, or even 100 per cent., for which they paid nothing. But prior to the date when the Standing Order was introduced and made compulsory upon all gas and water companies coming to Parliament afterwards, various gas companies had obtained in their Acts authority to issue their capital by auction in the same way. This Company was one of them. If the whole capital had been issued under the auction clauses, the Company would have been able to pay their maximum dividend, and could have supplied gas at 2½d. per 1000 cubic feet less than at present. The shareholders were getting their 7½ per cent. They could not get any more; and when they had been for a number of years in this position, the whole management of the Company was characterized by want of enterprise or dead-alive management. They had no interest in pushing the business. Although there had been a great opening for the supply of gas by prepayment meters, the Company had not availed themselves of it until this Bill was threatened. The consumers in the Company's district were only 40 per cent. of the inhabited houses; whereas in the British Gaslight Company's district they amounted to 73 per cent. of the inhabited houses, and in the district supplied by the Corporation there were more consumers than inhabited houses. From 1900 to 1906 the East Hull Gas Company supplied gas at 2s. 6d. per 1000 cubic feet. But when the opposition of the Corporation to the Bill of last year was announced, they reduced the price to 2s. 4d.; and when the Corporation decided to promote this Bill, the Company immediately reduced the figure to 2s. Their accounts showed that at this price they could not earn the necessary revenue to pay their maximum dividend. The reduction was made not as a business transaction, but so as to enable them to come before the Committee and say: "Why should this undertaking be transferred; we are supplying gas about the same price as the British Gaslight Company, and lower than the Corporation are?" But if the Bill were to pass, they would be compelled, if they wanted to go on paying their maximum dividend out of revenue, to put back the price to 2s. 4d. or 2s. 6d. The South Metropolitan Gas Company had been obliged to put up the price of gas because coal had gone up. One of

the best tests of good management of a gas company was the amount of unaccounted-for gas. In the case of the British Gaslight Company, this was 2·7 per cent. of the whole; in the case of the Corporation, it was 3·1 per cent.; and in the case of the East Hull Company, it was 7·9 per cent. The Corporation submitted that the time had now come for the transfer to be made. In their hands, the Corporation would raise the capital as Corporation stock—say, at 3½ or 3¾ per cent.; whereas the Company would have to raise it as gas capital, at about 5 per cent. There was no opposition to the transfer, excepting from the Company. The Local Authority in the district were supporting the Bill; a clause having been agreed with them. Dealing with the petition, Counsel said they contended that the Corporation proposal was unjustifiable and unprecedented, and that it was in reality a municipal trading scheme to be utilized as a means of making profits to be applied to the reduction of municipal rates. The only other petition—that of the North-Eastern Railway Company—was purely a clause question.

Mr. *F. J. Bancroft*, the Gas Engineer to the Hull Corporation, was then called. He said that the relative output of the three undertakings was: The British Gaslight Company, for the year ending December, 1905, supplied 1123 million cubic feet; the East Hull Gas Company, 177 million feet; and the Hull Corporation, 86 million. In 1867, the Company were authorized to issue further capital up to £76,000, which was to be of the nominal value of £10 per share, with a maximum dividend of 7½ per cent. A £10 share bearing such a dividend could have been sold by auction for £15, so as to return to the purchaser 5 per cent. In May of last year, when the Corporation opposed the Company's Bill, they reduced the price of gas; and in November there was a further reduction, which was not justifiable. If the undertaking were transferred, the Corporation would be able to effect economies, and the result would be generally satisfactory.

Mr. *E. H. Stevenson* said he had been over the works of the East Hull Company. The transfer of the old Kingston Company to the Corporation was beneficial to all concerned. The old Company were under no regulations whatever; and since 1824 they had never been to Parliament. They were selling gas of any quality they liked, and at any price, and dividing any profits they could earn. The profits divided were over 22 per cent.; but the profits earned were considerably more, and went in extension of the business. With regard to the East Hull Gas Company, the published accounts showed that when they came to Parliament they had overdrawn more than £7000; and the capital expended was more than the capital authorized in 1903. The shareholders could not in the future be in a better position than they were at the present time, since they were receiving maximum dividends. Therefore the time was very opportune for the transfer to be made to the Corporation.

Friday, July 5.

Mr. *Stevenson* resumed his evidence this morning. He said the district supplied by the Company was situated on the east of Hull, where there was every possibility of considerable growth in the population. It was a commonly accepted fact that if two moderate-sized undertakings were amalgamated, they could be worked more economically than if they were run as separate concerns. In nearly every case of purchase by local authorities the consumers had received benefit by a reduction in the price of gas, and the general body of ratepayers had also benefited by surplus profits being used in aid of the rates. The few cases which witness knew in which the price had been raised had all been undertakings which were transferred by agreement, without the price being settled by arbitration. It appeared, therefore, that where prices of undertakings had been arranged between the company and the local authority, there was more probability of the corporation paying a larger sum than the true value of the concern than where an arbitration took place and the price was settled by independent people. There were few places which showed that a loss had been suffered after paying all interest and sinking fund. Generally speaking the transfer of gas undertakings had benefited all parties. Gas companies bought out by arbitration had always received the full value of their property, although they did not generally receive what they asked for. The East Hull Company were a maximum price and maximum dividend concern, and therefore no improvements in manufacture, and no reduction in the price of gas, would enhance the value of the stock in the slightest degree. The dividend could not be increased, neither could the security of the holding. They had not in the past acted in the best interest of the consumer. In the event of the combination of the two undertakings, the cost of production and the working expenses would be considerably less. If the shareholders were compensated with the full market value of their shares, they could not reasonably say that it was unfair. The first reduction in the price of gas which the Company made was justifiable. With regard to the following reduction to 2s., however, he could only say that they would be unable to maintain their dividend at that price. But although this price was too low, he was of opinion that they could, and should, have made a reduction some time before they did, because in previous years there was a considerable surplus of revenue. All the Corporation asked for was that they should be allowed to become the gas purveyors in the district on fair terms; and they would pay the Company the full value for their undertaking.

Mr. *Charles Hunt*, in giving evidence, said the area of the Company's district of supply outside the City was of considerable extent, but contained a population of only 1400 or 1500; the number of inhabited houses being 323. At present, it was anomalous that the gas supply of any place having a single municipal authority should be in more hands than one. In cases where gas companies had been acquired by corporations, satisfaction had almost invariably resulted both to the consumer and the ratepayer. In very few instances loss had resulted; but in the great majority of cases, the price of gas had been reduced. In the present instance, it was clear that there would be immediate benefit to the consumer. The Board of Trade returns for 1905 showed that the total capital indebtedness on gas-works account of the local authorities owning gas undertakings, after the deduction of sinking funds, was at the rate of £471 per million cubic feet sold, as compared with £712 in 1882. They also showed that the capital of gas companies had increased during the same period from £724 to £840 per million cubic feet sold. The latter figure was largely attributable to stock conversion by many of the companies, by which 10 per cent. or 7 per cent. stock had been converted into a larger amount of stock bearing a lower rate of interest; but as the local authorities had usually had to pay large sums for goodwill, the comparison held good. The management of gas undertakings by corporations had been quite as satisfactory as those managed by companies; and he saw no reason in the circumstances at Hull why the city should prove an exception to the general rule. The fact that only 40 per cent. of the inhabited houses in the East Hull Company's district were consumers of gas, and that although the district was increasing the supply had only been increased by 36 per cent. in ten years, pointed to want of enterprise on the part of the Company. If the transfer were made, some £13 000 would be necessary to put the works in order and to make satisfactory arrangements to meet the requirements. He was sure there would be a decrease in the administrative costs.

Mr. *T. R. Ferens*, M.P. for East Hull, considered that it would be an advantage to the East Hull district, and to the City of Hull, if the powers sought by the Corporation were conferred upon them. He believed the Corporation would make the undertaking a success.

Alderman *Larard*, a member of the Hull City Council, expressed himself strongly in favour of the Corporation taking charge of all the gas undertakings there were. If this undertaking were now given over to them, it would be well and economically managed. The reduction which they had been able to make in the price of gas charged by the old Kingston Gas Company had been equal to a benefit to the ratepayers of between £11,000 and £12,000.

Mr. Balfour Browne then briefly addressed the Committee on behalf of the East Hull Company, contending that no case had been made by the promoters and that there were no complaints as to the management of the Company.

The Chairman then shortly consulted with his colleagues without clearing the room, and announced that the Committee were not prepared to proceed with this part of the Bill.

There being no opposition to the rest of the measure—the appearance of the North-Eastern Railway Company being a matter of clauses relating to gas matters—the clauses were finally adjusted.

METROPOLITAN WATER BOARD (VARIOUS POWERS) BILL.

(*Before Viscount* Cross, *Chairman*, *Earl* Bathurst, *Earl* Manvers, *Lord* Aberdare, *Viscount* Hill, *Sir* J. Randles, *Mr.* Rose, *Mr.* Whitbred, *Mr.* Duncan, *and Mr.* Luke Waite.)

The Joint Committee of the Houses of Lords and Commons, constituted as above, commenced the consideration of this Bill on Thursday, the 13th ult.

Mr. Fitzgerald, on behalf of the Board, explained that this was in the nature of an omnibus Bill dealing with a variety of matters in respect of which the Metropolitan Water Board desired to obtain further powers. It was divided into parts; and following the usual course in Bills of this character, he asked the Committee to postpone Part I., and begin by taking Part II., which could be dealt with by itself. The first work that was proposed under this part was a tunnel under the Thames at Richmond, just below Richmond Bridge. The reason for the tunnel was that it was necessary to safeguard the supplies of water to the western portion of London. At the present time there were two 36-inch mains, trunk mains, from the West Middlesex intake at Hampton to their reservoirs at Barnes, and these crossed beneath the Thames just below Richmond Bridge. Close to them were two other trunk mains (36 inches and 30 inches respectively) that were formerly laid by the Southwark and Vauxhall Company, and which passed under the Thames at this point. They were constructed of cast iron; but the Board were advised that if one of these mains burst, it might involve the bursting of the other, and create a most unfortunate situation. They were also advised that an accident to one of the West Middlesex mains might affect the other. Under these circumstances, they proposed to make the tunnel there and to put into it the four mains which now passed under the river. The estimate for doing this, including the necessary loans, was £35,400. They had arranged terms with the Corporation of Richmond, who were the owners of a small island in the river at that point (known as "Corporation Island"), and on which it might possibly be necessary to make a boring or construct some works. They had also arranged terms with the landowners on each side whose land was to be taken; and as far as he knew there was no opposition to the construction of the tunnel. The next works to construct were three lines of pipes or tracks, described in the Bill as so many conduits. The first track (Pipe-Track No. 1) was described in the Bill as Conduits 1 to 5; and it was for the purpose of taking a 30-inch main from Hampton to Hanwell, in order to give an increased and better supply to the whole of that district. A considerable part of this line of track was either under public roads or on land that already belonged to the Board; and where the main had to be laid under public roads the Board had already sufficient power under the Water-Works Clauses Act (the whole of the district being within the water limits), and they only required parliamentary authority where they had to lay the main under private lands, and for this purpose either to acquire the lands or an easement under them. The next line of pipes (Pipe-Track No. 2) commenced at Walton, and ran from there to the Rammey Marsh Well, and from there to the reservoir which was authorized in 1900 in the hands of the East London Company, and which was now about to be constructed. The object of this pipe-track was to get the surplus water from the well at Rammey Marsh and take it to the new reservoir when constructed. The last line of track was represented in the Bill by Conduits 9 to 23; beginning at Ditton, and carried from there to the present Norwood reservoir. In connection with this, it was proposed to construct a further reservoir by the side of the Norwood reservoir, to give additional storage there for the supply of the district. The conduits described in the Bill were merely the conduits for which parliamentary powers were required. There was also a new road mentioned in the work which was to have been constructed at Wandsworth; but this had been withdrawn—the

Wandsworth Borough Council having objected to it. Clause 25 in this part of the Bill gave power to the Board "to purchase by agreement, or take on lease, and acquire for the purpose of protecting from pollution any sources of water supply, or for any other purpose of their undertaking, any lands not exceeding in the whole 500 acres; but nothing in this section shall authorize the Board to create or permit the creation or continuance of any nuisance on such lands." He thought the only objection taken to this clause by the opponents was that it was suggested that it would be open to the Board to acquire lands, and then, without any parliamentary authority, to sink wells upon the lands and proceed to pump large supplies of water from them. To meet this objection, they proposed to add a proviso prohibiting the Board from using the lands to be acquired for the purpose of pumping water for a public supply.

After remarks from various Counsel on behalf of petitioners against the Bill, the consideration of this clause was postponed.

Mr. *W. B. Bryan*, the Engineer to the Water Board, stated, with regard to Part II. of the Bill, that he was generally responsible for preparing the works; and they were all necessary for the proper carrying out of the undertaking. The tunnel under the Thames near Richmond Bridge was for the accommodation of two 36-inch mains supplying the north side of the river, and one 30-inch main and one 36-inch main to supply the south of the river. In regard to the danger which he anticipated, and to remedy which they wanted the tunnel, in cases of existing mains crossing the bed of the river accidents had happened, necessitating perhaps as long as six or eight months before the repairs could be properly effected. Consequently, a main had been out of use the whole of that period. By putting them in a tunnel such difficulties were done away with, and repairs could be executed immediately. This affected both sides of the river. There was no engineering difficulty about the work; and they had settled with all the parties who were interested.

Witness was further examined in detail, and was then cross examined on behalf of local and county authorities, railway and tramway companies, and others.

Mr. *J. W. Restler*, the Deputy Chief Engineer to the Board, also gave evidence, and the clauses of Part II. were gone through, and certain points of difference adjusted; the witnesses being re-called and cross-examined.

Objections of landowners were put forward to the part of the Bill relating to the extension of time by seven years for the construction of a reservoir at Norwood. To meet local objections, the original plan had been revised; the area of the reservoir being curtailed by 36 acres and the bank raised by 8 feet.

On the resumption of the proceedings on the 18th ult.,

Mr. *Bryan* stated, in cross-examination respecting the proposed Island Barn Farm reservoir, that he was the author of the altered scheme, but not of the original one. He approved of the site which had been selected, and thought it an excellent one. He admitted that a small portion, along the River Ember, was liable to flooding. Both banks of the river were flooded. He had modified the scheme by reducing the area of the reservoir by 26 acres. With regard to Walton, that district was at present supplied by the West Surrey Water Company; and therefore the proposed reservoir, so far as water supply was concerned, would be of no benefit to it. The whole of the Mole Valley was very subject to flooding. The reservoir would to some extent hold up flood water in flood time; but it would be so minute as to be inappreciable. The modifications in the construction of the reservoir were made by reason of interviews with the Surveyor of the East and West Molesey Council. The Council wanted the Board to contribute to the cost of making a weir. He objected to the Board relieving the District Council of any portion of their proper obligations.

In re-examination by Mr. FITZGERALD, witness stated that since the Water Board came into possession of the Lambeth undertaking, they had found great difficulty in supplying the whole of the area. The district was increasing more rapidly than any other—at the rate of 25,000 persons per annum. It was a large district extending down as far as Croydon; and the reservoir was essential for the supply. The alterations did not increase the danger of flooding.

Mr. *Restler* (recalled) agreed with Mr. Bryan's evidence. He thought it absolutely necessary that the reservoir should be constructed. Without it, if the Thames Conservancy exercised their powers, the Board would be unable in the summer time to take the supply necessary for the district from the Thames. The alteration proposed in the original scheme would very materially diminish whatever chance there might have been under the old scheme of increasing the difficulties of the water getting away, because the lowest part of the Island Barn Farm was intended to have been raised, under the 1900 Act, 3 feet; and this would practically have thrown all the water to the northward on the north side of the reservoir into the Mole, and towards the bank which already existed on the northern side. The present average level of the ground was higher than the bank which had been made for the protection of the district.

Mr. *W. Vaux Graham* gave it as his opinion that the construction of the proposed reservoir would not have the effect of increasing the floods in the Mole to any measurable extent.

After witness had been cross-examined,

Mr. FREEMAN announced that this concluded the case for the promoters on this part of the Bill.

Evidence was then given by Mr. *G. R. Strachan*, Mr. *J. Stevenson*, the Surveyor to the Molesey Urban District Council, Mr. *H. C. Fread*, the Engineer and Surveyor to the Urban District Council of Esher, and Mr. *G. Chatterton*, on behalf of the Walton District Council, the East and West Molesey District Council, &c., to the effect that the construction of the reservoir would increase the danger of flooding to Molesey and to the Walton sewage farm.

Mr. LEWIS COWARD then opened the case in support of a petition against the Bill signed by eighteen gentlemen who had resided in the district of East Molesey for a large number of years. The petition represented in value estates certainly worth not less than £150,000 to £200,000. The estates came up to the land on which the reservoir was proposed to be constructed. The Committee were asked to extend the time for the construction of the reservoir; for in six weeks' time the powers expired altogether. Since 1900, the promoters had done nothing; so that the position before the Committee to-day was one of seeking to revive powers, and for these revival powers Parliament had always insisted on the strongest possible evidence. The offer to diminish the area of the reservoir by some 26 acres did not meet his objection any more than it met that of the District Councils. The Committee would hear from his witnesses that the Rivers Mole and Ember were absolutely independent, and always had been independent, of the question of the Thames floods. That was not what they feared. The witnesses would say that the whole of the Island Farm in time of floods was very nearly under water—that it was a sea of water. Above all, he wanted to impress on the Committee that the Island Farm contained important elements for the preservation of the whole of his clients' surrounding properties. Until this reservoir had been authorized, neither directly nor indirectly had his witnesses any knowledge whatever of what was going to be constructed at their gates. Mr. Bryan had suggested that the reservoir would shut out the sewage works of the Walton District Council, which were three-quarters of a mile away, and another sewage works which were no less than a mile-and-a-half away from the houses notably of Mr. Francis and Mr. Barnard, whom he would call.

Evidence was then given in support of the petition by Mr. *C. K. Francis*, Metropolitan Police Magistrate, of East Molesey Court, Mr. *E. K. Burstal* (who said the reservoir would cause additional flooding to the land because the greater part of the Island land was under water in flood times), Mr. *A. A. Barnard*, of "The Wilderness," East Molesey, Mr. *R. Cobb*, of "The Grove," Esher, and Mr. *L. H. Raw*, who lives on the north side of the River Mole.

Mr. FREEMAN, for the Board, said they were dealing with a reservoir which was sanctioned in 1900, and from the proceedings which then took place it was evident that at any rate most of the local authorities and landowners knew of the proposals, petitioned against the Bill, and appeared on the proceedings. The whole matter was then gone into thoroughly; and Parliament sanctioned the work being carried out. Had it not been owing to the peculiar circumstance that the Water Companies were purchased, the Lambeth Company could have made this reservoir and nobody could have said a word about it. It was only by an accident that they had to come and ask now for an extension of time to carry out the work. Strictly speaking, he did not think most of the petitioners would have been entitled to be heard; but the Board were very desirous of meeting the local authorities and everybody as far as they could. The whole point of the opposition was really to try to get the Board to carry out improvements in these rivers, which the local authorities, although they knew that the place was liable to flooding ever since 1878, had never spent one penny upon.

After a consultation,

The CHAIRMAN announced that the Committee were unanimously agreed that this extension of time should be granted as proposed (seven years). He then said there was a report from the Board of Agriculture on clause 42: The Water Board ask for confirmation of purchases of common land which appear to have been made by the East London Water-Works Company without statutory authority, and to be now vested in the Water Board, and for the extinguishing of the common rights affecting the lands. The Company were authorized by the East London Water-Works Act, 1900.

Mr. *A. B. Pilling*, the Clerk to the Board, having given evidence on the point which was satisfactory to the Committee,

Mr. BOYCE, for the Local Government Board, on clause 48, said he did not know why their suggestion should not be accepted. It had been accepted in a great many cases, and it was very customary that where their consent was now required it should be continued to be required. They suggested there should be the proviso added that "Nothing in the clause should be taken to dispense with the necessity of obtaining their consent to any alienation, lease, or other disposition of lands for which such consent would be required but for the provisions of the Bill." It was a very common practice to add such a proviso as this; and he did not see why they should not have it in the Bill.

Mr. FITZGERALD remarked that this placed the Water Board in an extreme difficulty.

Witness proceeded to explain, as to the necessity of the clause, that under the Water Board's existing Act of 1902, they had power to lease lands, and so on, with the consent of the Local Government Board. Now the Water Board's estates, lands, houses, &c., represented a rent roll of some £13,000 odd per annum, and some 1250 tenancies. The result of the section in the Board's present Act of Parliament was this: If they desired to let a cottage, even at 5s. a week, they had to make an application to the Local Government Board for their sanction to this particular transaction, and the matter could not be completed until they got it. Such a course was naturally extremely inconvenient and led to a great deal of delay; and all that the Water Board asked was that they might be given powers which were commonly possessed now by local authorities of managing their lands without having in every case to go to the Local Government Board for their consent.

Mr. BOYCE said that witness had not dealt with the suggestion which the Board made as regarded terms not exceeding seven years.

The CHAIRMAN said that if Mr. Fitzgerald accepted the Board's suggestion, he would get a lease for seven years, which would avoid trouble.

Mr. FITZGERALD promised to bring up a sub-clause on the subject.

A number of clauses were then dealt with and amended.

On the resumption of the proceedings on the 19th ult.

Mr. *A. B. Pilling* was examined by Mr. FITZGERALD with reference to clause 64. He stated that it gave power to the Board to provide, fix, and maintain meters, and to charge for them; and it also set forth that the Board should not be under any obligation to supply water by measure otherwise than through a meter or other instrument provided, fixed, or approved by them. While they took power to provide and fix meters, and to charge a rent for them, they did not confine the user of the meter to meters provided by the Board, but only to meters either provided or approved of by them. Under the Charges Bill, recently before the Committee, trade supplies were in future to be obligatory on the Board. There would therefore no longer be an opportunity for the

Board to introduce the meter protection in that Bill, so they sought it in this one. What they wanted to provide against was a meter being used that would not properly record the amount of the water supplied—in fact, at the present time the meters employed were almost invariably those supplied by the Board. A trader or any other person receiving a supply of water could use a meter of his own, provided it was approved by the Board.

Mr. PAGE, on behalf of the Railway Companies, accepted the words as to the approval by the Board.

In cross-examination by Mr. COWARD, witness denied that the Board proposed to have a monopoly in regard to the manufacture and supply of meters. The clause in the Water-Works Clauses Act, 1863, simply gave power of inspection; and they wanted a more direct control over the meter.

Mr. BANNATYNE, for the Home Office, stated that the sole objection they had to the proposal was that it left absolutely unfettered discretion to the Board to reject any meter. Their contention was that the Board should be required to approve any meter that conformed to specified requirements. These requirements might be stated either in regulations or, as in the Model Clause, in bye-laws; and the Home Office also asked that these bye-laws or regulations should be subject to the approval of a public department. He pointed out that this recommendation was based on the provisions of the Model Clause No. 14 of the Model Bills and Clauses.

Mr. COWARD submitted that the Model Clause was sufficient.

Mr. FORBES LANKESTER said that, on behalf of the City of London, they took somewhat the same view. They saw no reason for departing from the precedent of the Model Clause; and they would ask the Committee to adopt that clause.

Mr. FITZGERALD said that if the Home Office thought that there ought to be a power in the clause for the Board to make regulations subject to the approval either of the Local Government Board or of the Home Office, and where the meters were in accordance with those regulations the Board should approve them, he did not think there would be any objection to this; and the clause might be amended in that form. He would assent to an amendment of the clause in this way—it being understood that the Board had authority from time to time to inspect the meters. He proposed to add the following words: "Or approved by the Board, or which shall comply with any regulations of the Board as to the size or the construction, removal, user, and replacing of meters, which regulations they are hereby empowered to make, under and subject to the terms and conditions contained in the Metropolis Water Act, 1871."

Mr. BANNATYNE said that would meet the point of the Home Office.

Mr. BRYCE remarked that there ought to be some middle course.

After further discussion,

The CHAIRMAN announced that the clause, as amended, would stand part of the Bill, as follows:—

The Board shall not be under any obligation to supply water by measure otherwise than through a meter or other instrument so supplied provided and fixed or approved by the Board, or which shall comply with any regulations of the Board as to the size, nature, construction, testing, removal, user, and replacing of meters, which regulations they are hereby empowered to make under, and subject to, the terms and conditions with respect to regulations contained in the Metropolis Water Act, 1871. Provided that nothing in this section shall authorize the Board to refuse to supply water by meter until such regulations have come into operation.

Mr. FITZGERALD, dealing with another Home Office objection to clause 76, explained that the clause provided that, in case of an appeal or other legal proceeding, the Board should not be required to enter into a recognisance, and that

such requirement shall be deemed to be satisfied on the entry of appeal or undertaking of such proceeding by the Board. But in every such case the Board shall be liable as if recognisances had been entered into for such sum, if any, as is required by such Act or rules in case of any such appeal; and all entries of appeals or other proceedings shall be made and taken as if recognisances had been so entered into.

Witness, in explaining the difficulty and inconvenience that arose in cases of appeals and recognisances, illustrated it by referring to the appeals now proceeding against the rating in the City of London.

Mr. BANNATYNE said his objection to the proposal was based chiefly on general grounds; but there was a particular objection to which they called attention in their report. The general objection was that this was an alteration of the general law as to legal procedure in this country in favour of a particular body; and they submitted that this was a matter for a Public Act and not for private legislation.

Mr. FITZGERALD admitted that it was an alteration in procedure, but not an alteration in the law.

After further discussion,

The CHAIRMAN said the Committee would allow the clause to stand.

Clause 80 was one to enable the Board to

Lend temporarily upon the security of any stock, bonds, bills, or other properties in which Trustees are by the "Trustee Act, 1893," authorized to invest, or upon the security of Treasury bills, India bills, London County bills, Metropolitan Water Board bills, or certificates to bearer relating to stock in this section referred to, to any person or persons any sum of money which the Board may have in hand, provided (*a*) that no such loan shall be advanced for a longer period than three months, (*b*) that the aggregate of such loans outstanding at any one time shall not exceed £1,000,000, (*c*) that the Board shall, with the consent of the Local Government Board, determine the percentage by which the value of the securities required from borrowers shall exceed the amount of the loans advanced.

Lord *Welby*, the Chairman of the Finance Committee of the Water Board, explained the desirability of the powers sought under the clause.

After cross-examination and discussion,

Mr. FITZGERALD undertook to exclude any moneys forming part of the sinking fund or redemption fund; and the clause was ordered to stand over for the drawing up of words to cover the point.

Evidence having been given concerning the Sutton Water Company, the Railway Companies, and the Twickenham and Hampton Urban District Councils, on a new clause dealing with works, mains, &c.,

The CHAIRMAN said the Committee were agreed that the clause might be passed; but, of course, the Water Board would remember there was compensation that might be got if they made any mistake under the provisions of the Public Health Act, section 308, which gave protection to both railways and local authorities.

Mr. FITZGERALD said it was intended that this section should apply, and the same provisions with regard to compensation covered the case of the tramways.

Parts of the Bill dealing with superannuation funds for employees, &c., that had been left over for alterations to be made to meet the views of the Local Government Board, were next dealt with, and some other clauses were brought forward and amended.

Mr. FREEMAN, when the proceedings were resumed on the 20th ult., brought up a clause dealing with the recovery of rates, as follows:—

Proceedings for the recovery of the water-rates shall be for all purposes deemed to be proceedings for the recovery of civil debts, and notwithstanding that a period of more than six months has elapsed from the time when such water-rates became payable, the same may be recovered in a summary manner.

Mr. BOYCE, for the Local Government Board, objected to the words "notwithstanding that a period of more than six months has elapsed," submitting that there was no excuse for altering the general law in this case.

Mr. *Pilling* explained that, under the Water-Works Clauses Act of 1847, water-rates were payable quarterly in advance. It was, however, extremely inexpedient to send the collectors round every quarter; and therefore the custom was to make the collection half-yearly. The demand note was sent out in the middle of the half year. The result was that at the time the demand note went out the first three months' rate was already three months in arrear; and as the law limited them in the Police Courts in the recovery of these rates to six months, three months had elapsed before the demand note went out. They simply asked that the six months' limit be no longer imposed upon them. He proposed that the Board should come under the ordinary Statute, which would give them six years.

Mr. BOYCE submitted that there was no justification whatever for altering the general law as to the charges, because the summary power was an addition to the other powers in the County Court.

Mr. FREEMAN, replying to the Chairman, said the words he proposed were twelve months.

Mr. LUKE WHITE (a Member of the Committee): I think we should not alter the general law in a Private Bill,

The CHAIRMAN: The Committee are agreed that the general law is quite sufficient.

The clause was therefore struck out.

Clause 77, as to the making of contracts on behalf of the Board, gave them the same power as is given to companies under the Companies Act of 1867.

Mr. BOYCE objected on behalf of the Local Government Board, remarking that this involved a material alteration, as regarded the Water Board, of the general law relating to contracts made by corporate bodies—such contracts as a general rule being required to be made under the seal of a corporate body. "If the Committee are satisfied that the law in this matter, as applicable to the Water Board, requires alteration, the Board suggest for consideration whether the provision should not be limited to contracts below a specified amount or value." Then they gave the two precedents. At present the Water Board were subject to section 149 of the Metropolis Management Act, 1855, which involved the sealing of contracts exceeding £10; and the London County Council and other authorities outside London were subject to the section of the Public Health Act which involved sealing every contract of over £50. He was bound to say that, in his view, the £10 was probably too low in the case of London, because £50 was allowed outside. But he submitted that the general law ought not to be altered: and if any alteration was made, that the provision should be limited to contracts exceeding a specified sum.

Witness said the question of the purchase of goods by a body like the Water Board was not a case of £50 per contract, it was more like £5000; and the seal was then invariably used. But in these small questions things had to be done out of hand; and all the clause did was to say that where ordinary individuals might contract with each other without the use of a seal, so the Water Board might do.

Mr. BOYCE pressed upon the Committee that by this clause they would alter the law of contracts which applied all over the country, quite apart from the contract for goods. If the Committee wished to increase the limit, his suggestion was that, instead of having contracts of £10, the Committee should fix the limit and insert £50 instead of £10. So that the law as at present applicable would still apply to them; but the limit would be extended.

The CHAIRMAN, after the matter had been allowed to stand over for settlement as to the insertion of the figure, said it was proposed after the words "any contract" to insert the words "whereof the value or amount does not exceed £50, or any tenancy agreement whereby the rent reserved shall not exceed £50 per annum."

Mr. FORBES LANKESTER brought up a new clause for the City of London, the object of which was to oblige the Board, when they laid down a new pipe or main, or altered the position of an existing pipe, to put it in the existing subways which belonged to the City, and not lay it in a trench made for the purpose by the Board themselves.

Mr. FITZGERALD having objected that this clause did not arise upon the Bill, he asked the Committee to reject it; and the matter was allowed to stand over for a time.

Mr. BALFOUR BROWNE brought up a clause on behalf of the London United Tramways Company; but after legal arguments,

The CHAIRMAN said the Committee thought the tramways were amply protected as the law stood, and the clause was not wanted.

An agreed clause for the protection of Middlesex was added to the Bill.

Other new clauses were brought up and discussed relating to the Southall Urban District Council, and the Hampton, Hampton Wick, Heston and Isleworth, and Teddington and Twickenham District Councils.

Mr. CLODE, on resumption of proceedings on the 25th ult., brought up a long clause on behalf of the Railway Companies for their protection, putting upon the Board, among other things, obligations to carry out works and alterations under the Bill to the satisfaction of the

Companies concerned, without interfering with traffic, and to compensate them for any loss or damage arising. The promoters, he said, had told them that they could have protection if they withdrew from the Committee and did not claim their rights; but having, as he argued, come to a definite agreement with the Water Board officials, they were not going back. They adhered to their clause, the bulk of which he contended had been agreed.

Sir *Charles Owen*, the General Manager of the London and South Western Railway, said he had carefully studied the clauses proposed for the protection of the petitioning Railway Companies, who were, in effect, all the Railway Companies in London, except certain underground railways.

Mr. PAGE: With regard to the first five clauses, is it necessary that the Companies should have the protection mentioned in those clauses, so that in constructing, laying down, altering, or improving, or extending any conduits which go across, along, or under a railway, or affect the structure of any bridge which the Companies are liable to maintain, that work shall be done to the satisfaction of, and under the superintendence of, the Railway Companies?

Witness: It is absolutely necessary that such a clause should be given to the Companies in order that their engineers may protect and secure the safety of the public.

And is it fair, in your opinion, that all such works should be done at the expense of the Board?—That only follows the ordinary course observed in such matters.

Continuing, witness said it was equally reasonable that they should make good and restore any property and works of a railway company, and works which it was absolutely necessary to maintain throughout any alterations, in such condition that the traffic could be continuously and regularly maintained in the interests of the public. It was absolutely necessary that the Board should be bound not to do anything which would interrupt or delay the safe passage and conduct of the traffic on the lines.

Mr. FITZGERALD, replying to the Chairman, said he had no objection to many of the sub-sections of the clause, which did not carry the Railway Companies a bit farther than the general provisions of the Act of 1875. The point he took was that they were only placing themselves in the same position as every water authority throughout the country; and with regard to the specific works in this Act, they had already agreed with Sir Charles Owen, or his representative, a specific clause protecting the Companies.

Mr. PAGE protested against the action of the Water Board in the matter, asserting that he could prove that an absolute agreement was come to.

In cross-examination by Mr. FITZGERALD, witness said they simply required the retention of the full user of their property for the purpose for which they had purchased it. They were complaining of the broad powers given to the Water Board under the Bill, which made it a local authority with power to carry on general works without coming to Parliament in each individual case, and without coming for specific powers.

Mr. *C. L. Morgan*, the Engineer to the Brighton Company, said the Water Board had agreed no clauses whatever with them. The Company would be affected if the Board exercised the power asked for by the Bill, of crossing their line. For this purpose it was absolutely necessary that there should be a provision that they might take, at the Company's option, an easement instead of taking the land. They thought that any additional expense which the Company reasonably incurred by the user of their railway and land which they had for railway purposes, should be borne by the party causing the obstruction. The Board claimed power at any time to lay down new mains, and in any position. They might choose to lay them down at an inconvenient spot on the railway, and on certain of their bridges. In the enlargement of Victoria Station, his Company had come across pipes of all kinds, and water-mains in particular; and it had cost many thousands of pounds to deal with them.

Answering Mr. FITZGERALD, in cross-examination, witness said he did not say that they would be prevented from widening their line; but by reason of the Board's works, if they did widen it, they would be put to very considerable extra expense. Under the Railway Clauses Act they had power to move and alter the position of any water pipe or main; but they had to pay the cost.

Mr. FITZGERALD pointed out that this discussion really arose on a new clause (55) which the Committee had accepted, and which simply put the Water Board in the position of every public authority throughout the kingdom who had the construction of either sewers or waterworks in their hands.

After further argument,

The CHAIRMAN (the Committee having consulted) said that at the beginning of the discussion he asked the question why everybody was not content with the general law as contained in section 308 of the Public Health Act. Everything that could be said in favour of the clause had since been said. The Committee were unanimous in saying that the Railway Companies had, in their opinion, all the protection they wanted under the general law.

The clause was therefore rejected.

A clause submitted by the Postmaster-General, applying the Telegraph Act of 1878, and giving wayleaves over the property of the Board, was next briefly discussed.

Mr. FREEMAN having read a letter from the Postmaster-General in support of his view,

The CHAIRMAN said: The Committee decide to insert the Postmaster-General's clause as submitted.

The following new clause, which Mr. Freeman said had been arranged, was then inserted:—

Notwithstanding anything contained in this or any other Act, the following provisions for the protection of the Mayor, Aldermen, and Commons of the City of London in Common Council assembled (in this section referred to as the "Corporation") shall, unless otherwise agreed between the Board and the Corporation, apply and have effect: Where in any street or place within the City of London the Corporation have constructed a subway or other work for the reception of pipes, wires, and other apparatus, such subway or other work shall, as regards all mains and pipes hereafter placed or renewed by the Board in any such street or place, be deemed to be a public service work within the meaning of part 5 of the "City of London (Various Powers) Act, 1900," and the provisions of that part of that Act shall, so far as applicable, extend and apply accordingly to such subway or other work, and to such mains and pipes belonging to the Board. Provided that whenever any main or pipe now in position shall cease to be used by the Board, such main or pipe shall, unless the Board think fit to remove the same, be sufficiently closed and stopped off to the reasonable satisfaction of the Corporation, and thereafter the Corporation shall hold harmless and indemnify the Board from and against all actions, claims, and demands, expenses or liability in respect thereof, and such mains or pipes shall be deemed to have been abandoned and become the property of the Corporation.

Agreed clauses for the protection of the Metropolitan Railway Company and for the Commissioners of Works having been inserted,

Mr. FREEMAN stated that the Treasury had submitted a clause for the protection of the Windsor Water-Works, the effect being to restrict the Board from sinking wells within a prescribed area; but he suggested that the Lord Chairman's clause, which had now been inserted in the Bill, and which was the general clause, covered the whole of it. It was therefore not necessary to have a separate clause for Windsor. The clause ran—

The Board shall not take any water or sink any wells in the valley of the Thames or the Colne, or their tributories, north of a line drawn east and west through the Royal Mausoleum at Windsor, except with the approval of the Commissioners of Works.

The Board could not agree to this. They had communicated with the Treasury to the effect that they could not accept the clause because it took in the whole of the watershed of the Thames and the Lea; and they had pointed out that they were now put under limitation by the Lord Chairman's clause as to sinking wells except upon the specific ground.

Mr. *W. B. Bryan* gave evidence to the effect that the Treasury clause, so far as the area on which they would draw water was concerned, would hamper the Water Board, not only as regarded their present powers, but for all future time. Since the clause was sent, the Lord Chairman's clause had been passed, limiting the taking of water; and, in his opinion, the latter clause covered the matter raised by the Treasury, and gave perfect protection.

The CHAIRMAN intimated that the Committee would not insert the clause.

The preamble of the Bill was then declared passed.

Price of Nitrate of Soda.—According to the half-yearly report of Mr. Thomson Aikman, jun., the world's consumption of nitrate of soda in the twelvemonth ended the 30th ult. amounted to 1,675,000 tons, compared with 1,610,000 tons in 1905-6—an increase of 65,000 tons; while the average price per hundredweight was 11s., against 10s. 9d. This figure is the highest for the past 24 years; the average price in 1882-3, when the consumption was 430,000 tons, having been 12s. 3d. The lowest since that date was 7s. 4½d. per cwt.—in 1897-8.

Electric Lighting at Brighton.—The electricity accounts of the Brighton Corporation show a loss on last year's working of £10,233; and the reserve fund has to be reduced one-half to meet this. The capital expenditure at the close of the financial year amounted to £758,279. The total revenue dropped from £86,076 a year ago to £81,415, though the number of customers had increased from 4387 to 4500. The gross profit was £33,971—a decrease of £3461; the percentage of gross profit to capital fell from 6·45 two years ago and 5·71 last year to 4·6, though there was a slight saving in the "works" costs.

Gas and Water Supply in the Rhymney Valley.—At the meeting of the Rhymney District Council last Wednesday, the Surveyor gave an account of the proceedings at the conference recently held at Caerphilly to consider the question of acquiring the gas and water works of the Rhymney and Aber Valleys Gas and Water Company, as reported in the "JOURNAL" for the 25th ult. (p. 1015); and it was decided that the Council should take no further part in the movement. A report was also given of the conference held at Newport to consider the Monmouthshire water scheme, to which reference was made in the same issue (p. 1021); and it was resolved that the same representatives should attend the next meeting and oppose the scheme.

Price of Gas at Malvern.—Owing to the rise in the price of coal, the tenders at Malvern represent an increase of nearly £1500, which has not been provided for in the estimated expenditure for the current year; and the Gas Committee recommended that the amount be dealt with at the close of the financial year. When the matter came before the Council, the Chairman of the Committee (Mr. Moerschell) urged that, as the profits from the gas-works went to relieve the rates, the non-consumers of gas should share in the extra expense owing to the increased price of coal. Mr. Sparkes said that if the matter be left till the end of the year they would have to pay the whole increase for this year of about £1600. Mr. Moerschell replied that £3112 had been handed over from the gas-works for the relief of the rates last year. Mr. Sparkes then moved an amendment that the price of gas be raised to 3s. 8d. per 1000 cubic feet. This, however, was lost, and the Committee's report was adopted.

Oldbury Gas Department.—At the monthly meeting of the Oldbury District Council last Friday, the accounts of the Gas Department for the year ending the 31st of March last, prepared by the Manager (Mr. A. Cooke), were presented. The principal items were given in the "JOURNAL" last week (p. 53). In moving the adoption of the accounts, the Chairman of the Gas Committee (Mr. J. W. Wilson, M.P.), remarked that they were very satisfactory; and, considering the position and size of the works, the amount of profit realized compared very favourably with neighbouring local authorities. He pointed out that in the near future it would be necessary to increase the storage for gas at the works. There was no other town in the Midlands with less gasholder capacity than Oldbury. He also alluded to the satisfactory increase in the sales of gas. A discussion ensued, in which it was urged that more of the profit from the gas undertaking should be applied in relief of the district rates; and Mr. Jackson intimated that he would move a resolution on the subject at a future meeting. The statement of accounts was then adopted.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, July 5.

(*Before Mr. Justice* SWINFEN EADY.)

Attorney-General v. Rhymney and Aber Valleys Gas and Water Company.

This was an action by the Attorney-General, on the information of the Caerphilly Urban District Council, and also by the Council; and the only issue of fact to be tried was whether the defendants had, in accordance with their statutory obligations, supplied pure and wholesome water to the Council's district, or whether they had been persistently supplying water of impure and unwholesome character, which was dangerous to health.

Mr. EVE, K.C., and Mr. ROWLANDS appeared for the plaintiffs; Mr. MACNAGHTEN, K.C., and Mr. AUSTEN-CARTMELL represented the defendants.

Mr. EVE, in opening the case, said the Company was incorporated by Act of Parliament in 1898, with the object of acquiring the works of a previously existing Company, and of giving statutory effect to certain agreements with several local authorities, among which the Caerphilly District Council were included. Having gone through the material clauses in the Act, which included power to construct reservoirs, Counsel said these powers had not been fully exercised, and the only important reservoir which had been constructed was at the north of the Council's district, at Ystradmynach. It held 42 million gallons. In October, 1902, an agreement was entered into under which the defendants acquired the water-works then belonging to the Council. These were very small, and their use had not been continued. [Counsel put in a plan, showing the district and the various reservoirs.] Speaking roughly, the population within the defendants' area of supply was 60,000 or 70,000, of which the Council's district accounted for about 30,000. It was rapidly increasing; something like 1000 houses per annum being built, which, of course, entailed an increasing demand for water.

Justice SWINFEN EADY asked if the complaint was as to the quantity or the quality of the water, or both.

Mr. EVE said the quality was the only question raised in the action. The real cause of contamination was at the very top of the area. It was said that this source of supply was not always resorted to; but there was evidence that it was used occasionally, and with the growth of the population it must be drawn upon more and more. The topmost reservoir originally belonged to the Rhymney Iron Company, and was fed by a stream called the Pittgwellt, which was a pure source. But in the immediate vicinity there was a farm which might cause pollution. The overflow went on to reservoir No. 2, holding 42 million gallons, which was also fed by the Pittgwellt and the Blaen Rhymney Brook; and there were serious contaminations to the supply between these two reservoirs. Counsel produced photographs showing these reservoirs, and also the various service reservoirs, or tanks, which helped to gather water on the way down to Caerphilly; and he said the great objection to them was that they were not fenced in or covered, and were open to various kinds of contamination. There having been a good deal of illness in the district, the Medical Officer's attention was called to the water; and in 1905 various samples were taken and examined by the County Analyst, whose analysis was so unsatisfactory that in February, 1906, other samples were taken and sent to Dr. William Smith, who made both chemical and bacteriological analyses of them. Counsel went on to state the results, which would, he said, be given in evidence. The effect of them was that nearly all the samples were condemned as unfit for domestic use. The relief asked was an injunction to restrain the defendants from permitting impure and unwholesome water to flow in their mains and pipes.

Justice SWINFEN EADY suggested that this was not a very convenient form of injunction, as the defendants might obey it by cutting off the supply altogether.

Mr. EVE said what the plaintiffs really wanted was to secure a proper supply of water, which it was believed could be done by providing filtration works and taking measures to prevent pollution.

Justice SWINFEN EADY asked if it was a question of allowing time to do the necessary works.

Mr. MACNAGHTEN said the defendants disputed the correctness of the analyses produced. They had offered to concur in appointing an expert to report and advise on the whole matter; but this had been refused by the Council.

Mr. EVE said he would now call evidence in support of his case.

Mr. *James Watson*, the Engineer to the Bradford Corporation, said he visited the *locus in quo* last June, and went over the whole district shown on the plan. He considered the defendants' storage capacity was inadequate for such a population. The gathering-ground on the Brecon Hills was excellent. The Rhymney Iron Company's reservoir held 5 million gallons, and there was no complaint to be made about it. There were no filtration works; but there were filter-beds lower down the valley, but not in working order. The second reservoir was fed in part by the overflow from the first and in part by the Blaen Rhymney stream. Between the first and second reservoirs there was a farm closely adjoining the stream, which he considered a very dangerous source of contamination. There was a manure pit very near the reservoir, and some of the cattle sheds actually drained into the stream. There were no sanitary conveniences that he could see about the farm, except one dry closet. There was another farm which drained into the stream, though it stood 200 or 300 feet from it. The reservoir was not fenced at all. Work was being carried on involving the presence of a number of men; but no conveniences were provided. He then came southwards, and inspected the service-tanks on the way to Caerphilly. There was one at Derl, which was properly fenced in. Farther south he came to Ystradmynach, where the pumping-station was. There were several cisterns there which were much coated with decayed vegetable matter. Farther on he came to Llanbradach, where there was another service reservoir, which was partly fed by a stream from the hills. By the side of it there was a considerable amount of *débris* which had evidently been taken from the tank. Witness went on to describe the other works on the way to Caerphilly, none of which furnished water which, in his opinion, was satisfactory for a domestic supply, except that at Cwm Ceffyl. These various service reservoirs were not sufficient for the supply of Caerphilly without aid from the large reservoirs. At Watford there was a good reservoir, which at the time of his visit was partially fenced in, and was fed from a distance. In his opinion, the small service reservoirs should be eliminated, and, if not, filtration works should be provided. He had seen the analyses of the water, and they were just what he should have expected from what he had witnessed.

Cross-examined: He considered a supply of 20 gallons per head per day very moderate. Nowadays this was a small supply for all purposes. The defendants' district was not a difficult one to supply, nor would it be very expensive. He was there two days. His principal complaints with regard to the second reservoir were the farm and the men at work close to it, with no conveniences. If the Company bought the farm, and prevented human habitation and the manuring of the land there, it would remove his principal objection.

Mr. *E. T. Morgan*, Inspector of Nuisances, proved the taking of samples of water in 1905 at the Watford reservoir, and in February, 1906, three samples from different houses in Caerphilly, Senghenydd, and Aber. The water came right off the mains; there being no cisterns. In September last year he took five other samples, which were all sent to London to the Institute of Public Analysts; and two other samples were afterwards taken. He had often noticed that the water was muddy and discoloured. There was typhoid fever in some of the houses where he took the samples. He spoke to seeing a dead dog and other objectionable matters in the reservoir.

Cross-examined: The water was put in sterilized bottles with glass stoppers sent from the Institute in a locked box. He let the water run for a quarter of an hour before taking the samples. About a month ago he saw sheep round the Watford reservoir, and manure on the fields surrounding the Senghenydd reservoir, which was supplied mainly from a spring. The surface water used to get in until lately; but it could not do so now.

Saturday, July 6.

Dr. *T. W. Thomas*, the Medical Officer of Health to the Caerphilly Urban District Council, said it was his duty to report on notifiable diseases occurring in the district; and he had included in his reports observations on the water supply. He was acquainted with the various tanks and reservoirs from which the district was supplied with water; and he agreed with the evidence given by Mr. Watson with regard to them. The unfenced condition of the Watford reservoir had been a matter of complaint for some time, and many outbreaks of diarrhœa and typhoid were due to the state of the water. In July, 1905, he reported to the Council that the samples taken were again unsatisfactory, as they showed evidence of contamination. Water from the Ystradmynach reservoir was unsuitable for domestic use; and he suggested that it should be boiled before being used. He produced the analyses received from the County Analyst, which, he said, confirmed his suspicion as to the unsatisfactory condition of the water; the number of organisms being too many to count. In February, 1906, he instructed the Inspector to take further samples, and to send them to Dr. Smith. He had examined water drawn from taps, and the appearance varied considerably. Sometimes it was pretty clear; but generally it was turbid and contained insects. The means of filtration were insufficient. He had seen surface water flowing into the Senghenydd reservoir as lately as the 10th of April last, and should say the adjacent gathering-grounds were unsuitable, as they consisted of manured fields. To put an end to contamination, the farmhouses should be done away with, proper supervision exercised over the intake, and efficient filtration provided.

Cross-examined: No complaint had been made by the Council with regard to the Blaen Rhymney supply before the commencement of the action. He did not know that the defendants took over the supply to Caerphilly about February, 1893, or that before then the Council supplied water from Nant-y-Galch. He had reported unfavourably about the quality of this water; and he believed the supply had now been discontinued. In 1904, the Council wrote to the Water Company stating that they were going to apply to the Attorney-General to institute proceedings. A number of analyses of the water were made at Cardiff, and the report was that it was a moderately pure water. No proceedings were taken. On July 24, 1905, he reported that further samples of water had been analyzed, and that they showed no signs of contamination by sewage or animal or vegetable matter. His principal objection was to the unfenced condition of the Watford reservoir. After his report, there were several cases of typhoid fever; but he did not attribute them to the water, as, in his opinion, they were due to defective sewerage. Water would not give persons typhoid fever unless there were typhoid germs in the supply.

Mr. *Joseph Howell*, a member of the Caerphilly Council, produced samples of the Company's water taken in his house in January last—some from the scullery tap and others from the bath tap, which was supplied direct from the main. All were very dirty, and no one, he said, would think of drinking the water. In April, accompanied by two members of the Council, he visited the reservoirs; and from what he saw, he was able to confirm the evidence given by Mr. Watson.

Cross-examined: The samples he produced had not been analyzed. He admitted that in January last the Company wrote to the Council suggesting that an independent analyst should be appointed to examine the water; and if anything needed remedying they said they would do it. This offer was not accepted, though personally he was in favour of it being done.

Mr. *H. A. Scholberg*, of the Cardiff and County Public Health Laboratory (who attended under subpœna), said he had had submitted to him from time to time various samples of water which he had

examined bacteriologically. In one sample, taken from the Watford reservoir, the organisms developing at 37° C. were too many to count; the number developing at 20° C. was 126; and *bacillus coli* developed at 0·1°C. The water was most unsatisfactory—there being strong evidence of contamination. Other analyses showed similar results.

Cross-examined: It was undesirable that *bacillus coli* should be present in water, though many drinking waters contained it. He should not condemn the water on this account alone, seeing that the percentage was very small. He did not attach much importance to the number of organisms, unless they were excessive; the number depended a great deal upon where the water came from. If going any distance, samples should be packed in ice.

Re-examined: The statement in a text-book, that "the presence of the *bacillus coli* in drinking water should always be regarded with grave suspicion," was too sweeping. No doubt its presence was due to contamination by sewage; and the water containing it could not be considered pure.

The hearing was continued yesterday, when evidence was given by Dr. W. R. Smith, F.R.S., the Principal of the Royal Institute of Public Health, and the plaintiffs' case closed. Mr. Macnaghten then opened the case for the defendants, and contended that the water supplied by them was pure and wholesome within the meaning of the Act. He called in support of his contention Mr. E. K. Burstal (of Messrs. Stevenson and Burstal), Sir William Crookes, F.R.S., and Mr. Henry Crookes, F.C.S., and the Court adjourned till this morning.

THE PRICE OF GAS IN MESSINA.

The Dispute between the Municipality and the Continental Union Gas Company, Limited.

The claim of the Municipality of Messina (Sicily) to share in the economies effected in the manufacture of gas by the Continental Union Gas Company, Limited, who hold the concession for lighting the town, was referred to in a communicated article in the "JOURNAL" for Aug. 21, 1906 (p. 517). From our contemporary, "Il Gaz," we now learn that the dispute has been settled, and that the *Collegio Arbitrale* have given their award. They declare that the Commune of Messina, by virtue of article 7 of the agreement of Sept. 16, 1861, have the right to a half share in the economies obtained by the Gas Company in public and private lighting which are due to scientific progress and the adoption of modern methods of coal-gas manufacture. Such methods are stated to be: (1) The introduction of exhausters, (2) new processes of purification, and (3) regenerative furnaces. They declare that the right of the Commune to profit by the economies due to these three means commences from Jan. 29, 1906, which is the date when these proceedings were commenced, and that their right continues during the whole subsequent period of the concession. The economies which have accrued under these three headings are estimated as being 0·96, 0·19, and 0·85 of a centime—that is, in all, 2 c. per cubic metre of gas sold to the consumer (equivalent to 5½d. per 1000 cubic feet of gas). The price of gas, both for public lighting and for private purposes, ought therefore at once to be reduced to one-half of this saving, or by 1 c. per cubic metre. The Company are ordered to pay to the Commune the sum of 12,618·65 lire (about £506), with the legal interest upon it from the date of judgment to that of payment. Other demands of the Commune are rejected. The taxed costs of the proceedings are fixed at 1312·45 lire (£52), of which the Company have to pay one-third; while the costs of the three Arbitrators amount to 18,000 lire (£720), of which each party must pay half.

Claim for Reinstatement Expenses.

In the Westminster County Court on Friday, his Honour Judge Woodfall gave judgment in the case of the *Metropolitan Water Board v. Wheeler and Son*, which was an action to recover £21 for reinstating ground opened for the purpose of repairing a burst pipe at the defendants' premises in New King's Road. The defendants undertook to pay the cost of opening and reinstating the ground—an area 4 feet by 2 feet. The plaintiffs opened the ground and filled it in; but the Fulham Borough Council completed the job, and found, owing to percolation, that it was necessary to reinstate an area 30 feet by 12 feet, and the account for the work amounted to £21. This sum the plaintiffs paid, and sought to recover it from the defendants. The defence was that the undertaking was to pay for the reinstatement of the area opened by the plaintiffs; and it was contended they were not liable for the extra area the Borough Council chose to reinstate. His Honour said no intimation was given to the defendants that the area was to be extended. He found the whole of the work done was necessary and the charge reasonable; but he was of opinion that the defendants' liability only extended to the outlay necessary to repair the pipe, and for this they had paid £3. The parties were both mistaken as to the extent of ground it would be necessary to reinstate—neither of them contemplating the amount of damage to the highway. He gave judgment for the defendants, with costs; but said if the plaintiffs desired to appeal he would give leave on their undertaking to pay the costs in any event.

Gas v. Electricity for Workhouses.—The Brentford Guardians had before them at their last meeting offers from the Heston and Isleworth District Council to supply electricity, and from the Brentford Gas Company to supply gas, to the workhouse buildings. The Council quoted 3d. per unit for five years, with a minimum consumption of 50,000 units. The Gas Company's quotation was 2s. 5d. per 1000 cubic feet for the whole of the buildings. In support of the installation of electricity, it was urged that the new buildings had been wired; and it was also contended that the municipal enterprise should be supported. The advocates of gas pointed out its cheapness and the absence of troublesome conditions in the Company's offer. In the result, it was decided by a large majority to accept the Company's quotation.

MISCELLANEOUS NEWS.

MUNICIPAL TRADING CONSIDERATIONS.

Meeting of the Industrial Freedom League.

In the course of the proceedings at the Fifth Annual Meeting of the Industrial Freedom League, which was held in London last Thursday, considerable reference was made to gas, electricity, and water questions, as will be seen by the following notes from the speeches. The gathering was not a very large one; but what it lacked in numbers it made up for in enthusiasm. The chair was occupied by Sir FELIX SCHUSTER, Bart., who is well known in City financial circles as the Governor of the Union of London and Smith's Bank, Limited.

The CHAIRMAN, in the course of his speech when moving the adoption of the report and statement of accounts, said that the former testified to the useful work carried on by the League, under circumstances of considerable importance to the community at large. His task was made easier, and at the same time more difficult, because they would have the privilege of hearing the resolution seconded by the one man who had made the subject peculiarly his own, and could speak on it with far greater authority than he (the Chairman) could. He referred, of course, to Lord Avebury; and even his Lordship might find some difficulty in adding to the arguments he had so ably adduced, and supported by such valuable evidence, in that remarkable book of his on "Municipal and National Trading,"* a work in which it would appear that the last word had been said, and which seemed unanswerable. He was sure they would not think it out of place if, in the name of the members of the League, he tendered to Lord Avebury their warmest thanks for the great service he had rendered to the community by the issue of this work, at a time when the enlightenment of the public was greatly needed.

INDIVIDUAL EFFORT OR MUNICIPAL MONOPOLY.

The League was not a political organization, and included members of all parties; but during the recent elections they called upon the voters to give their support only to those candidates who were in favour of the principle of individual effort and enterprise, as opposed to municipal trading and monopoly. He thought they might claim that the people of London had now given these principles their emphatic approval. Monopoly was injurious to the community under any circumstances. A State or municipal monopoly was, however, worse than any other, on account of the absence of that control by the public authority to which all other monopolies, should they exist, must be subject. Far be it from him to assert that there were not many undertakings of public utility which by their nature could only be carried out by public authorities, and for which private enterprise was not so well adapted. It was in order not to hamper authorities in carrying out such work, and to keep their credit unimpaired, that they wished to free them from the risks of trading in matters which required the experience, energy, and effort of the individual, and to which no large body of men, however able, could possibly attend with the same efficiency. It might be asserted that, as regarded the development of trade generally, one of the most remarkable features of the Nineteenth Century had been the growth of joint-stock enterprise; that joint-stock companies had successfully competed with private traders; and that elected bodies corresponded to boards of directors in a joint-stock company carrying on large undertakings. But let it be always remembered that such directors were much fewer in number; that they were not elected by popular vote, but chosen for special experience in a particular line; and that even among joint-stock companies only those had been found to be really progressive and prosperous in which individual effort and sense of responsibility had found full scope.

THE CASE OF LONDON.

The evidence of Sir Melvill Beachcroft, the Chairman of the Metropolitan Water Board, in this respect was so valuable that it deserved to be put on record. In his review of the work performed by the Board during his four years of office, he said: "So far it must be admitted that no saving had been effected. He did not think it was ever anticipated that there would be any saving in the expenses of administration, as the management of a trading concern by a municipal body must always involve expenditure quite outside that which fell on the private company." He added that the advantages must be sought in another direction; and he also stated that the official staff numbered 732, as compared with 599 when the undertakings were handed over, and the employees 3153, as against 2997 at the time of transfer. In connection with this statement, it would be remembered that in 1902 the Special Arbitration Committee of the Board reported that an approximate annual saving of close upon £95,000 was to be anticipated, that additional profits in the future were to be expected, and that further substantial economies also might be looked for. The ratepayers were certainly not led to expect an increase in the charge for water, which in some instances had already taken place, and which, if the Bill now before Parliament became law, would impose (under the guise of equalization of rates) heavy additional burdens on certain classes of the community. The ratepayers of London, and especially the traders of the City, should see to it before it was too late that the Bill did not pass in its present state, else serious loss would accrue. So much for the financial aspect of this latest substitution of municipal for private enterprise; and they would all agree with Lord Avebury that the supply of water was perhaps the strongest case that could be made out for municipal enterprise. Whether any advantage would be derived from a more generous supply and more careful safeguards as to purity, remained to be seen. As regarded electric power, they all knew how far ambitious schemes had hindered the development of private enterprise, thus preventing the public from obtaining the supply which, without risk to the ratepayers, private undertakings could no doubt

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* See "JOURNAL," Vol. XCVII., p. 22.

have provided. Here, again, the best and most economical solution of a difficult problem would appear to be the open competition of private enterprise, subject always to public control. It should be borne in mind that, as pointed out in the report of the Royal Commission on London Traffic, in other countries it was not unusual for municipalities to construct, purchase, or otherwise acquire undertakings of public utility, while leaving the actual working to companies, with provision for proper rates and general control; and that it was claimed that such methods yielded better financial results, and avoided difficulties that might arise from municipal authorities carrying on business on a large scale.

EFFECT OF EXCESSIVE BORROWING.

He had already referred to the necessity of keeping the credit of municipalities unimpaired, in order to enable them to carry out the many duties encumbent upon them. That this credit did not stand so high as they would like to see it, there was no doubt. Capital was easily alarmed; and credit once lost was not readily regained. It was quite true that many causes had contributed to the depreciation in the market for so-called gilt-edged securities; but there could be no doubt that excessive borrowing by municipalities was largely responsible for the prevailing depression. The one remedy seemed to be strict regard for sound financial principles. In Germany, the country of "lavish municipal expenditure," according to the Lord Mayor, the laws which regulated municipal borrowing were very strict. But even there reports stated that municipal borrowing had been considered excessive; that money for municipal loans was to be obtained only with great difficulty; and that not only municipal credit, but also National credit, had suffered accordingly. In the United States the same symptoms were to be observed; and the City of New York, which not many years ago was able to obtain loans on a 2½ per cent. basis, had had to increase the rate to 3½ per cent., and the previous week could not successfully float an issue on a 4 per cent. basis. It was the same here. Ten years ago, the London County Council issued 2½ per cent. stock at an average price of £100 9s. 8d.; but this stock was now quoted at about £72, and the latest issue was a 3½ per cent. stock at £97. As he had said, other causes had contributed to this depreciation; but the very high municipal borrowings were to a large extent responsible for it.

THE AUDITING OF ACCOUNTS.

A resolution was to be moved with regard to the auditing of accounts of municipal authorities; and he need not enlarge upon it, except to say that it would have his warmest support. They were all glad to see that the London County Council had now accepted the principle which the League had advocated so long; and they would look forward with great interest to the report which the independent Auditors were going to prepare with regard to the various enterprises the Council had embarked upon. It was to be sincerely hoped that the example thus set by the foremost Municipality in the kingdom would soon be followed by others. Among the matters that should be fought against was the deprivation of joint-stock companies of the right to vote; and there remained in other directions plenty of work for the League, which existed, not in the interests of one section, but in those of the community at large—and especially in the interests of the working classes, whose welfare, and whose very livelihood indeed, they believed, were absolutely dependent upon the continued unfettered progress of that private enterprise and individual freedom to which the commercial prosperity of this country was so pre-eminently due.

MUNICIPAL ELECTRICAL UNDERTAKINGS.

Lord AVEBURY, who seconded the motion, remarked that he was surprisd to see that in a speech a few days previous the President of the Board of Trade had stated that the gross profit made by provincial municipal electrical concerns was £2,000,000; and he characterized this as a great triumph for municipal enterprise. The gross profit, however, of an undertaking really indicated nothing. What one wanted to know was the net profit; and if the President of the Board of Trade had gone further, and looked at the net result, he would not have had much reason to congratulate himself or the unfortunate ratepayers. The total amount invested in these undertakings was shown in the "Electrical Times" to be £34,884,000; and as the rate of interest paid by municipalities was now about 3½ per cent., and in many cases more, this would represent just over £1,000,000. Then there came the question of what ought to be allowed for depreciation. Much of the machinery employed was of a character which did not last very long; and moreover such improvements were continually being made that very often machinery which would go on working would still be better consigned to the scrap-heap, because it could be replaced by other more suitable for its task. Those who had had experience would be generally agreed that to take 3½ per cent. for depreciation would be very moderate. This would come to another £1,000,000, which made £2,000,000 altogether to be deducted from the gross profit, and left nothing as the result of the working of these great undertakings. But this was not quite all, because they now knew that a very inadequate amount had been allocated, as regarded tramways and other similar undertakings of the London County Council, for rent, central staff, law expenses, &c.; and if fair charges had been made in these items, he ventured to assert it would have thrown the balance considerably on the wrong side.

THE COST OF STREET LIGHTING.

Then there was another matter. He regretted to say that it was very much the custom, in connection with these municipal enterprises, to charge an undue amount for street lighting. If they took London, the heaviest sums charged for street lighting carried out by municipalities—without mentioning names—were £259, £204, £198, and £194 per mile. The highest charges made in the localities where the municipalities wisely availed themselves of private enterprise were £176, £120, £100, and £91 per mile. The lowest figure was £156 for municipalities; whereas the two lowest amounts charged by gas companies were £74 and £72. Therefore the lowest of the municipalities was, with one single exception, higher than the highest of the cases where private enterprise was doing the work. It was perfectly clear that a very undue amount had been charged for public lighting, which went to make the profits of the electric installations look larger than they were.

THE LONDON WATER PURCHASE.

He had always endeavoured to persuade his fellow citizens in London that they would gain nothing by buying up the Water Companies; and he thought most of them now agreed with that. The water was the same; and there was no more of it. The question of purity was important; and there was greater security in this respect when they had the Water Companies watched vigilantly—he might say jealously, but not too jealously—by the London County Council than now, when there was practically nobody to look after the supply more than there was before, and, in fact, somewhat less. He was not saying this to criticize the Water Board. They had a most excellent Chairman in Sir Melvill Beachcroft. He had done everything man could do; but he (the speaker) did not believe any Municipal Water Board could manage an undertaking so well as it was managed before, and he was afraid they would all have to pay heavily for the change which he ventured to think was so unwisely made.

THE POLICY OF THE LEAGUE.

In the last few days, they had seen another development, in the throwing out of the Electrical Bill of the present County Council. This meant that people would have to pay higher rates than they need for an electricity supply, because the present House of Commons would not, if they could help it, allow anything to be done by private enterprise. The main reasons which seemed to him to justify the policy of the League were: (1) That local expenditure was increasing more rapidly than rateable property. (2) That local indebtedness was increasing more rapidly than rateable property. (3) That municipal trading could not fail to give rise to awkward labour problems. (4) That municipal trading had seriously interfered with private enterprise and with foreign commerce. (5) That it was unwise to give votes to those who paid no rates, and unjust to withhold them from those who did. (6) That by reducing the demand for labour, while increasing prices and raising rates, municipal trading had not only injured ratepayers generally, but especially the working classes, and that carried to its logical conclusion it would involve the loss of their freedom.

The resolution having been carried unanimously,

Colonel Sir JOHN E. BINGHAM, Bart., proposed the re-election of the officers; and, in doing so, he remarked that the low price of gas in many places kept down the price of electricity, which was greatly to the advantage of the ratepayers.

PRICE OF GAS IN YORKSHIRE—THE SHEFFIELD UNDERTAKING.

With reference to the prices charged by 39 authorities in Yorkshire who owned their gas-works, he saw there were 14 of them charging 3s. to 3s. 9d. per 1000 cubic feet; 19 from 2s. 6d. to 2s. 11d.; 6 from 2s. 1d. to 2s. 5d.; and none under 2s. 1d. The average of the lot was 2s. 10d. per 1000 cubic feet—a good deal more than double the price of Sheffield gas. But as touching municipal speculation. They were met in Sheffield by a proposition to buy up the gas-works, which had done so well for the city. He had nothing against the gentleman who proposed it; but, to his mind, it could be for no other reason than to endeavour to make the electric lighting pay by increasing the cost of gas and appearing to make money for the city, and then by increasing the price of electric light. He could promise Sheffield that the price of gas, without any profit to the city, would come out at a higher figure than at present. The existing low price was a very great gain, more especially to the working classes.

A RESOLUTION ON AUDITING.

Mr. Deputy GEORGE EDWARDS proposed—"That this meeting regrets that steps have not been taken to put in force the recommendations of the Joint Select Committee of the House of Lords and the House of Commons on Municipal Trading, in regard to the audit of the accounts of local authorities, and that, though the audit of the Local Government Board was unanimously condemned by the Joint Committee, the scope of its operations is being constantly extended; and that a copy of this resolution be sent to the Prime Minister, the President of the Local Government Board, and the President of the Board of Trade." He remarked that if a reliable audit was necessary for a public company which the shareholders had only entered voluntarily, it was much more necessary for a municipality where the people had to subscribe by a levy of rates whether they wished to do so or not. If an undertaking was carried on in a skilful manner, there should be no fear—in fact, an independent auditor's report should be welcomed by all. No auditor could direct the policy or management, nor prevent the making of bad bargains; but he could place such information and figures before the public as might save them from living in a "fool's paradise." It was not a question of party politics, as both sides were agreed on the principle; and therefore they could with confidence ask the Government to take steps as speedily as possible to carry into effect the recommendation made by the Joint Committee four years ago.

Mr. J. M. FELLS, in seconding the resolution (which was agreed to), pointed out that many municipalities were in favour of such an audit as was hinted at.

A LONDON TRAFFIC BOARD.

The final business resolution passed was as follows: "That in the opinion of this meeting, the creation of a Traffic Board in relation to locomotion and transport over the area of 'Greater London,' as recommended by the Royal Commission on London Traffic, is of the utmost importance; and that His Majesty's Government should be urged to bring in a Bill to give effect thereto without delay; and that a copy of this resolution be sent to the Prime Minister and the President of the Board of Trade."

The CHAIRMAN, in acknowledging a vote of thanks, laid stress upon the fact that in his earlier remarks he had not meant in any way to criticize Sir Melvill Beachcroft, who was put into a position which he had admitted was a most difficult one. He had carried on the work admirably, and so had the whole of the Board; but what the League maintained was that even the best of men could not make the Board that success which was expected.

POULTON-LE-FYLDE GAS ARBITRATION.

The Value of Part of an Undertaking.

At the Surveyors Institution, Westminster, on the 28th and 29th ult., and the 1st and 2nd inst., Mr. H. GRAHAM HARRIS, M.Inst.C.E., presided, as sole Umpire, to assess the compensation to be paid the Poulton-le-Fylde (Lancs.) Urban District Council, who are the proprietors of the gas-works in the district, for the portion of their undertaking which is in the area of the Thornton Urban District Council, which the latter Council are taking over.

Mr. E. F. VESEY KNOX, K.C., and Mr. T. E. MANSFIELD appeared for the Poulton-le-Fylde Council; and Mr. SUTTON, K.C., and Mr. C. C. HUTCHINSON represented the Thornton Council.

Mr. VESEY KNOX, in opening, said the gas was originally supplied to the district by a Mr. Parkinson, who started the works in 1885; and in 1888 a private Company was formed to run the undertaking. Under the statutory Order forming the Company, it was provided that if within fourteen years Poulton was formed into a local urban authority, that authority should have power to purchase the gas undertaking at the expiration of seven or within fourteen years. In 1900, the township became a Local Authority; and in 1901 they obtained an Act authorizing them to take over the gas-works. This they did under arbitration, at which Mr. Ernest Moon, K.C., acted as Umpire; Mr. Thomas Newbigging being Arbitrator for the Company, and Mr. Valon for Poulton. The sum awarded was £18,133, including some portion of the costs. A part of the area of supply was in the district of Thornton; and when Poulton obtained their Act, a clause was inserted which provided that if any local authority part of whose district was within the area of supply at any time gave notice of their desire to purchase such portion of the Poulton undertaking, that authority should not oppose. The Thornton district in 1900 became an Urban Authority. In 1903 they gave notice to Poulton of their desire to buy out the part of their gas undertaking within the Thornton boundaries, and in 1905 gave the necessary statutory notice to purchase. As an agreement could not be arrived at, this arbitration resulted. Counsel pointed out that the maximum price allowed to be charged by Poulton was 7s. 6d. per 1000 cubic feet, and the candle power 12. The price charged, however, had not been more than 3s. 9d. For the purposes of the award, it had been agreed that the capital of the undertaking with the addition of the sum of £3644, the cost of the arbitration, should be taken at £23,775. In Thornton the area of supply was 1158 acres, out of 3539 acres—the area of Thornton. In 1896, the sale of gas was 2,977,000 cubic feet; in 1901 it had gone up to 7,000,000 feet; in 1905-6 it had increased to 10,307,000 feet; and in 1906-7 the sales were 11,005,000 feet. There was a gross increase of 50 per cent. in four years. The gross rental from Poulton was £2092 15s. 3d., and from Thornton £235 3s. 7d. In Poulton, 80 per cent. of the population were consumers; and it was claimed that within a short period it would be the same in Thornton. Taking this as the basis of the calculation, and the profit in the district at 28 years' purchase, it was claimed that the value of the Thornton area was £15,400. But to obtain this a further expenditure of capital, at the rate of £850 per extra million cubic feet supplied, would have to be incurred on a total of 6,000,600 feet. This would reduce the sum by £4188; making the amount of the claim £11,212. This they suggested should be deferred for a period of three years, by which time they calculated they would have secured the same percentage of consumers as Poulton. To the total again would have to be added a proportion of the £3000 incurred by Poulton in fighting the Gas Company.

Mr. *J. B. Moss*, the Surveyor to the Urban District Council of Poulton, proved the various plans and maps put in, and Mr. *Drummond*, a Surveyor and Architect of Fleetwood, gave evidence to the effect that various building estates were being laid out in the Thornton district which would increase the number of consumers.

Mr. *J. L. Walker*, the Gas Manager at Poulton, described the works in detail, and said they were of sufficient size to meet the growing requirements of the whole district. If Thornton were taken away, the use of a large part of the works would not be required for many years to come. There was a gasholder capable of holding 18,000 cubic feet; another prepared for telescoping, which would hold 26,000 feet, and with little cost could be made to hold 30,000 feet. Their present capacity was 44,000 feet; and with a little expenditure the storage could be increased by another 30,000 feet.

Mr. *E. W. Drew* (of Messrs. Wood, Drew, and Co.) said the purchase price of the undertaking from the Company was £18,331, and £1800 for repayment of loan capital. Subsequent to the transfer to the Council there were other payments for the cost of the arbitration, compensation to Secretary, &c., bringing the total spent in acquiring the undertaking by the Poulton Council up to £23,925 1s. 7d. After the works were taken over, the Council expended a further sum on plant, mains, fittings, &c., bringing the capital expenditure up to £26,404 18s. 10d. The profits shown on gas were £944 18s. 1d. in 1904, £956 1s. 6d. in 1905, and £1110 1s. 8d. in 1906. This was not a profit in the relief of rates, because there was interest and sinking fund to be paid, and there were deficiencies in the corresponding years of £615, £603, and £774; but it was profits he would have counted as profits had he been making out the accounts of a gas company.

Mr. *H. E. Jones*, dealing with the valuation of the part of the undertaking in Thornton, said Mr. Drew brought out in round figures the profit at 2s. 2d. per 1000 cubic feet of gas. Taking the population of Poulton and Thornton at 4425 in 1906, he found that they consumed 10,307,000 cubic feet of gas. In 1907, the sale of gas was considerably larger, and had gone up 5 per cent. in one year in Thornton. In Poulton there were 406 consumers, who consumed 9,485,000 cubic feet; and he allocated to them a profit of £1027. On this basis, the estimated population of Thornton (1925) would consume 6,600,000 cubic feet. Taking the same basis of profit as now made, this would amount to £720. But it would take some year or two to gather the full crop of consumers; and he would reduce the figure of profit to 1s. 8d. per 1000 feet. This would bring down the figure of profit to £550. This, on a 28 years' purchase, gave a total of £15,400. To obtain this profit, additional works, capital, fitting, &c., would be required to the extent of £4188 net—bringing the £15,400 down to £11,212. But Thornton should contribute toward the expenses incurred in getting the undertaking from the Company; and he said they should pay £1650 for this—making the total claim £12,862. Taking off the amount allowed for having deferred the compensation for three years, his total worked out at £11,575.

Mr. *W. Newbigging*, in giving evidence, said he considered Thornton would be a better consuming district than Poulton when it was fully developed. In order to supply the increased demand, he placed the additional expenditure at £700 per million cubic feet on 5,770,000 feet. He thought the calculation that 80 per cent. of the residents in Thornton would use gas a reasonable one, and also that this 80 per cent. would be obtained in three years. His valuation was £11,288 4s. 10d.

Mr. *Robert Porter*, the Engineer and Manager of the Elland Gas Company, considered the existing works at Poulton were sufficient to allow for considerable extension of business. The plant was all in advance of requirements for some years to come, and the taking of Thornton would adversely affect the plant so far as its earning capacity was concerned.

This concluded the claimants' case.

Mr. SUTTON did not address the Umpire for the Thornton Council, but proceeded to call witnesses.

Mr. *Arthur Hindle* said he had assisted the Thornton Council in respect of the existing gas undertaking. The Cleveleys part of Thornton would be the first to develop—this being a large area on the Blackpool side; but the area now under discussion would be slow in developing. He estimated the expenditure of the Poulton Council to get through to the Thornton area at £1425. Deducting certain expenditure for works not attributable to the area itself, he said that the net amount should be £981.

Mr. *E. H. Stevenson*, who was engaged in the arbitration between the Gas Company and the Poulton Council when the latter took over the works, said there was no material alteration in the works since then, with the exception of certain new works spoken of, which were really replacements. He placed the consumption in the Thornton area in 1907 at 1,234,000 cubic feet, and the whole area at 11 million feet. The income from 1¼ million feet of gas (the consumption in Poulton) was what they had to purchase that day. He contended that the works to-day were bearing all they possibly could. There was absolutely no stand-by. The maximum make and maximum sale were practically the same; and the taking away of Thornton would be a benefit to them. The value of the works in Thornton he placed at £981. Having regard to all the circumstances, he fixed the net profit per 1000 cubic feet at 19·03d. instead of 25 85d. shown by the Poulton authority. In ascertaining the proportion of permanent works due to Thornton, he had taken 11 per cent. of the total sales. He found the total value of the existing works to be £6875. The proportion of gas sold in Poulton to that in Thornton was as 88 to 11; and he had taken 11 per cent. of the works value. This would give £770. He took a return of 4 per cent., and estimated the profit in Thornton at £82 for normal supply and £16 for the remainder. This he capitalized on the basis of 22·22 years' purchase; and having made allowances for any sterilization that might ensue through separation (to the extent of one year), he got the commercial value of the Thornton part of the undertaking, which was £1208. There should be no allowance for compulsory purchase, as the Poulton Act provided that the undertaking might be taken over at any time.

Mr. *J. Wilkinson*, the Engineer and Manager to the Halifax Corporation Gas-Works, gave evidence to the effect that he calculated the profit per 1000 cubic feet at 18·92d. The total profit derived from Thornton he estimated at £97 5s. 7d. per annum. This he dealt with upon the basis of 22·22 years' purchase. After making allowances for certain items of expenditure which would be incurred, his net valuation was £1238 16s.

Mr. *Isaac Carr* produced similar figures to the previous witness.

Mr. *F. H. Gorst* gave evidence to the effect that the growth of Thornton would be slow, owing to a portion being liable to flooding.

Mr. SUTTON, in the course of reviewing the evidence, contended that a greatly exaggerated view had been taken by the claimants as to the value of the part of their undertaking under discussion. They were not entitled to goodwill under their Act, and could not claim 10 per cent. for compulsory purchase.

This concluded the proceedings; the Umpire intimating that he reserved his award.

COMPANIES AND LOCAL AUTHORITIES AS TRADERS.

The time of the members of the Aldershot District Council was needlessly occupied at the last meeting in listening to the Chairman (Mr. C. A. L. Calvert) inveighing against the Aldershot Gas and Water Company for having exercised their perfectly legitimate rights. Certain water consumers, owing to financial difficulties, had been unable to pay their accounts, and consequently their supply had been cut off. This was characterized by the Chairman as "a most arbitrary action." He said the Council were trying to raise the health of the town, and they had a Company who could render all their efforts void by cutting off a water supply without notice. How was it possible, he asked, for the Council to improve the health of the town while such a thing existed? He proposed that a Committee should be formed to go into the matter; and, if necessary, he would be prepared to ask Parliament to alter the "drastic powers" the Company possessed. A man could not live without water—it was a necessity; and he considered the Company ought to give at least three months' notice of their intention to cut off the supply. In the midst of what a member characterized as the "rather destructive suggestions" that were being made, Mr. Bateman put a very sensible question as to whether the Company had exceeded their powers; and the Chairman acknowledged that they had not. The Rev. de Verd Leigh asked the Chairman if it would meet his wish if he proposed that a letter should be written to the Company

asking them if they could give at least three months' notice in case of cutting off water under circumstances similar to those in the cases in question. Mr. Robertson pointed out that this was entirely against the law—"a law they made to suit themselves," was the Chairman's comment. But it met with a negative reply from Mr. Robertson. The Rev. de Verd Leigh suggested that, as the Company had said they were willing to consider anything that would be for the good of the town, it would be wise for the Council to approach them in a friendly spirit, and ask them to deal leniently with cases such as those which had been referred to. Mr. May said if they acted on this suggestion, people would be asking them what they did when a man did not pay his electric lighting rate. "Have we summoned a man when he has not paid his electric light rate?" asked the Chairman. "Yes," replied Mr. May; "and stopped his supply." The answer was received with laughter. Eventually the Council decided to write to the Company.

DARLINGTON CORPORATION GAS SUPPLY.

The Past Year's Working.

We have received from the Gas Engineer and Manager of the Darlington Corporation (Mr. Frank P. Tarratt) the accounts and statistics of the gas undertaking for the year ended the 31st of March, as prepared by Mr. J. W. Armitage, the Borough Accountant. The sale of 324,783,812 cubic feet of gas for public and private lighting produced a revenue of £33,970; meter and stove rents came to £1735; residuals realized £12,422; and the profit of the fittings department for the year was £133—the total receipts being £48,751. The expenditure on material and handling of same for the manufacture of gas was £18,116 (coal costing £17,657); stokers' wages came to £4201; repairs of works and plant to £5248; distribution cost £2234; rents, rates, and taxes amounted to £2288; management to £1288, and other expenses made a total of £35,271—leaving a balance of £13,480. This sum, added to the amount brought forward, made £18,719, of which £4042 was transferred to the liquidation of loans account, £3113 was paid for interest, £4000 was transferred to the district fund in aid of the rates, £1239 was placed to reserve account, and £6325 was carried to the balance-sheet. The capital invested in the undertaking on the 31st of March last was £185,013, being equal to 11s. 5d. per 1000 cubic feet of gas sold, and the gross profit was equal to 7·287 per cent., and the net profit to 3·419 per cent. upon it. The quantity of coal carbonized was 36,124 tons; and the gas made was 350,743,000 cubic feet, of which 330,434,812 cubic feet were accounted for, or 92·33 per cent. of the make. The revenue from gas was equal to 2s. 1·102d. per 1000 cubic feet sold; but as the net cost was 1s. 3·141d., the gross profit was 9·961d. The net price charged to ordinary consumers is 2s., to large consumers 1s. 10d., and to those on the prepayment system 3s. 1d. per 1000 cubic feet. For power purposes, the price is 1s. 6d.

LONGTON CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The accounts of the Gas Department of the Longton Corporation for the year ending the 31st of March have been issued. They are signed by the Engineer and Manager (Mr. W. Langford), who has also charge of the electricity undertaking of the Corporation. The report of the Committee (of which Alderman Brookfield is Chairman) sets forth that the total quantity of gas made in the year was 151,076,000 cubic feet; being an increase of 5,484,000 cubic feet, or 3·76 per cent. The gas sold showed an increase of 5,591,000 cubic feet; while the gas unaccounted for equalled 6·24 per cent., which for a mining district was satisfactory. Twelve months ago, the price of gas for motive power was substantially reduced; and the Committee are pleased to report an increase in the sale for this purpose of 1,502,000 cubic feet. The total number of gas-engines in use is 69. The following figures show the consumption: Gas sold for motive power, 11,462,200 cubic feet; for lighting and heating (ordinary meters), 64,051,000 cubic feet; for lighting and heating (slot meters), 44,365,800 cubic feet; for public lighting, 20,070,000 cubic feet. The works and plant were well maintained; and no additions were made to the capital account. The Committee say the general working results were very satisfactory; the make of gas per ton of coal and per retort being the highest recorded. The profit on the year's working amounts to £10,321, against £9662. This profit has been carried to the net revenue account; and after deducting interest and sinking fund charges (amounting to £6058), and paying over £2500 to the borough fund in relief of rates, together with £501 placed to the reserve and depreciation fund, there remains a further balance of £1262. From this, the Committee recommend that the loss of £201 on the Electricity Department for the year should be made good, and that the balance of £1061 should be dealt with as follows: £531 to go to the debit balance on the Gas Department, and £530 to the debit balance on the Electricity Department. This disposes of the whole of the gas profits, and leaves a debit balance on the Gas Department of £874. Since 1878, when the gas-works were acquired by the Corporation, £62,897 has been paid into the borough fund in relief of the rates. When Mr. Langford presented his report to the Committee, they expressed their great satisfaction with the results; and, in addition to according him the customary vote of thanks, the Chairman said he hoped they would retain his services for many years.

The report came before the Town Council last Thursday, when some additional particulars were submitted. They showed that the cost of gas manufactured was reduced last year by £734, compared with the year 1905-6, notwithstanding the increased output of 5,484,000 cubic feet of gas. The repairs, renewals, and maintenance of works and plant were less by £922, chiefly due to the fact that the Committee have now paid off the whole cost of the carburetted water-gas plant, which has been done by annual instalments, instead of adding to the capital account. The slot consumers continue to increase; the amount received from this source being £7580, compared with £7307 before. Repairs and conversions of public lamps from flat-flame to incandescent burners cost £325 more than in 1905-6. The total quantity of gas sold amounted to £21,022, against £21,113. This was only about £90 less than in 1905-6, though the price of gas for motive power had been greatly reduced; some large consumers obtaining gas at 1s. 10½d. per 1000 cubic feet. The amount received from residuals was £4760—an increase of £113; while the fittings account produced £515, or an increase of £418. The yield of gas per ton of coal, independent of water or oil gas, was 12,260 cubic feet; the gas sold per ton of coal, independent of water or oil gas, was 11,496 cubic feet; and the gas unaccounted for, 6·24 per cent. of the make. The coke sold per ton of coal used was 11·06 cwt.; used as fuel for the retort-furnaces, 14·9 per cent. of the make; the oil used per 1000 cubic feet for water gas was 1 93 gallons; the tar made per ton of coal, 12 gallons.

DONCASTER CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The accounts of the Gas Department of the Doncaster Corporation for the year ending the 31st of March have just been issued. The revenue from the sale of gas to ordinary consumers (the price of which was reduced by 2d. per 1000 cubic feet on April 1, 1906) amounted to £15,556; and from prepayment consumers to £5546. The gas supplied to the public buildings and lamps, private lamps, and stove-rents increased the above-named amounts (less discounts and allowances) to £24,917; residuals yielded £7596; and the total revenue was £33,371. The chief items of expenditure were: Manufacture of gas (including repair and maintenance of works), £17,088; do. of sulphate of ammonia, £693; distribution (including repair and maintenance of meters, mains, and services), £2094; maintenance of stoves and fittings, £739; public light department, £1215; management and general charges, £1123. The total expenditure was £24,165; leaving £9206 to go to the net revenue account. The Gas Engineer to the Corporation (Mr. Robert Watson) recently submitted to the Gas Committee an analytical statement of the costs per ton of coal carbonized and per 1000 cubic feet of gas sold, as per the revenue account for the past financial year. It showed that the net cost of gas into the holder was £10,158; being at the rate of 9s. 8·4d. per ton of coal and 1s. 0·47d. per 1000 cubic feet of gas sold. The net cost of gas distributed was £15,705, or at the rates of 14s. 11·96d. and 1s. 7·29d. The gross profit, as stated above, was £9206, or at the rates of 8s. 9·54d. and 11·3d. Deducting the interest on loans, deposits, and sinking fund instalment, the surplus profit for the year was £8065, or at the rates of 7s. 8·46d. per ton of coal and 9 9d. per 1000 cubic feet of gas sold. The surplus profit was subject to the payment of £5000 to the borough fund and £1587 for cookers—the rest being for new mains and meters. The Gas Engineer also submitted a working statement for the past year. It showed that the total quantity of coal used was 20,943 tons, which produced 212,410,000 cubic feet of gas, or at the rate of 10,133 cubic feet per ton, of which 9353 cubic feet were sold, of an illuminating power of 17 candles. Of the total make of gas, 195,884,300 cubic feet, or 92·23 per cent., were sold; 3,232,400 cubic feet, or 1·52 per cent., used on the works; and 13,302,300 cubic feet, or 6·25 per cent., unaccounted for.

COVENTRY CORPORATION GAS UNDERTAKING.

In the last number of the "JOURNAL" (p. 47), we gave the principal figures in the annual report of the Gas Committee of the Coventry Corporation, which came before the City Council on the 2nd inst.

In moving the adoption of the report, the Chairman of the Committee (Mr. Batchelor) stated that the total quantity of gas sold was upwards of 764 million cubic feet—an increase over the previous year of 51 millions, or 7·23 per cent. This was made up, in round figures, as follows: Ordinary consumers, 30 millions; prepayment consumers, 20 millions; public lighting, rather more than half-a-million. The prepayment meters still grew in popularity; the consumption of gas through them having increased nearly 21 per cent. in the year. Coal cost 4d. per ton (net) less than in 1905-6; and though 1959 tons more had been carbonized, the cost had only been £30 higher. On the other hand, gas oil had gone up in price by ¼d. per gallon, or rather over 8 per cent.; and, owing to the augmented gas consumption, the quantity of this gas made during the past winter was double that of the previous similar period, which accounted for an increase under this head of £2173. It was the general impression that carburetted water gas was made because it was cheaper than coal gas; but this was not so. There might be times, when a low price was ruling for coke and the price of oil was low, when it would pay to make it; but during a period of normal consumption, when the number of retorts in use could be kept fairly constant, and average prices for residuals obtained, it paid best to shut down the water-gas plant. They were not making any of this gas now, as the retorts could supply the present demand; but in the depth of winter, when the maximum consumption was reached, it answered better to make all the extra gas in that plant than start special retorts for a short period, which was wasteful. The prices realized for residuals, except sulphate of ammonia, had been maintained. Fortunately, a greater yield of sulphate had been obtained per ton of coal carbonized; so that the result was slightly better than last year. The yield of gas had been lower than in the previous year, as many of the retorts were getting worn out, and expenditure on plant had been avoided as much as possible in view of the early transfer of gas making to Foleshill. The cost of manufacture had risen in slightly greater proportion than the increase in the quantity of gas made. The higher cost of carburetted water gas accounted chiefly for this; also the extra cost of running two works, as more foremen and workmen were required. The maintenance charges had gone up, owing to the removal of the carburetted water-gas plant to Foleshill. Rates, taxes, and public

lighting were higher; but the other items were much the same as last year. Bad debts had been exceptionally low—less than £25, which was a very small sum considering that the turnover was upwards of £127,000. There was a drop of only £488 in the receipts for gas; but there would have been an increase of £6144 had it not been for the reduction in the price of gas, which took effect as from the commencement of the financial year. This amounted to £6632 on the year's accounts. The average price of gas was lower now than it had been at any time since the Corporation acquired the undertaking, being 2s. 2·21d. per 1000 cubic feet. The next lowest price was 2s. 3·08d., which was for the year ending March, 1900. The Committee recommended that £2000 of the net profits should be voted to the relief of the rates, and that the balance of £1492 should be carried forward. The prospects for the current twelve months were not so good as they had been for the last few years, owing to the advance in the price of coals, which would have the effect of increasing the cost under this head by about £6000. This, however, would be somewhat reduced by the enhanced prices obtained for coke. The cost of gas oil would, it was feared, also be considerably augmented; and there was practically no residual product from this to reduce the additional cost. A large expenditure of capital would also take place at Foleshill during the current year; and it was estimated that the greater costs with the increased interest on capital would be about £5600. Against this, they anticipated lower maintenance charges; and if the present rate of consumption continued, they believed the new costs would be met. The Foleshill works were steadily progressing; and it was expected that the manufacture of coal gas would be commenced there within the next twelve months.

The motion for the adoption of the report was seconded by Mr. Player without comment.

A short discussion followed, in the course of which it was urged by Alderman Andrews that the policy of the Committee in selling gas at a lower figure than it cost to produce it, was a wrong one. The reduction in price had been apparently in favour of the large users to the extent of about £6000. Revising the price to this class of consumers was a financial mistake; and the small amount of profit made had shown that it was unsatisfactory. Alderman West, the Chairman of the Electric Light Committee, considered the profit made was very small, having regard to the turnover; it being less than 1 per cent. Mr. Poole urged that some concession should be made to small as well as to large consumers, and particularly to those using prepayment meters.

In the result, the report was adopted.

OSSETT CORPORATION GAS UNDERTAKING.

The Past Year's Working.

The report of the Gas Manager of the Ossett Corporation (Mr. A. E. Mottram) for the year ending the 31st of March last recently came before the Town Council in the minutes of the Gas Committee. It showed that the make of gas in the period named was 111,751,000 cubic feet, of which 102,178,600 cubic feet were sold. This was an increase of 6,828,000 cubic feet in the former case, and of 7,938,600 cubic feet in the latter, compared with the year 1905-6. The increased consumption was at the rate of 7 per cent.; and the unaccounted-for gas was reduced to 8½ per cent. The quantity of gas made per ton of coal carbonized was 10,885 cubic feet, against 10,833 cubic feet. The gas sold was apportioned as follows: Ordinary meters, 60,576,000 cubic feet; slot meters, 20,171,700 cubic feet; public lamps, 8,928,800 cubic feet; engines, 6,163,300 cubic feet; cookers, 5,346,300 cubic feet; works, offices, &c., 992,500 cubic feet. The gross profit made was £7790; and the interest and sinking fund charges amounted to £6516—leaving a net profit of £1274, which has been applied in reduction of the suspense and depreciation accounts. The price realized for surplus coke was a very low one; but there was nevertheless an increased income of £300, owing to the success met with in breaking and distributing the coke locally. By this means the surplus coke was reduced 30 per cent. There are 3674 consumers by ordinary meters and 3081 by prepayment meters—a total of 6755, or 352 more than in the year 1905-6.

Appended was a table showing the cost of gas per 1000 cubic feet sold. The gross cost of production was 2s. 0·65d., compared with 1s. 11·95d. before. Residuals realized 8·46d. per 1000 cubic feet of gas, against 8·12d. This reduced the net cost, exclusive of capital charges, to 1s. 4·19d., against 1s. 3·82d. Interest and sinking fund payments amounted to 1s. 3·29d., compared with 1s. 5d.; making the total cost of production 2s. 7·48d., or 1·33d. less than in 1905-6, when it was 2s. 8·83d. Receipts from gas, meter-rents, &c., amounted to 2s. 10·50d. per 1000 cubic feet; leaving a profit of 3·02d., against 1·73d.

In moving the confirmation of the minutes, the Chairman of the Gas Committee (Mr. H. Robinson) remarked that they had had a record year in almost every sense. If the Council considered the gas-works as an instrument of production, as a profit-making machine, or from the standpoint of consumption indicating the loyalty and satisfaction of the consumers, their success was quite phenomenal, especially when it was remembered that the advance was made upon great advances every year since the works came into the hands of the Corporation. There was one thing they had to regret. The success had not been so great, and the prospects were not sufficiently favourable, for any concessions to be made to the consumers this year, as the Manager had fondly hoped, and the patience of their customers merited. What stood between the public and cheaper gas were the capital charges and the bad condition and insufficiency of the mains and services. The latter were still being found in an awful condition; but the capital charges were the great bugbear, and made him wish the Corporation had been pioneers in this business, or had been enterprising enough to purchase the gas-works twenty or thirty years earlier. These charges were to him like a huge monster with a voracious appetite. This year it had swallowed in interest £4537, and in redemption of loan £1979—a total of £6516; and yet it was not satisfied, for next year they would have to feed it with an almost equal amount. Though the feed was getting gradually less, they would not have an appreciable difference for four or five years yet. During the past year, 111,751,000 cubic feet of gas had been made; showing that the works were a veritable hive of industry. The sale was 102,178,600 cubic feet, leaving unaccounted for 9,572,400 cubic feet, or 8½ per cent., being 1½ per cent. less than before. Compared with the year preceding the acquisition of the works by the Corporation, these figures were striking, and showed an increased make of 27,525,000 cubic feet, an increased sale of 31,335,000 cubic feet, and a decreased leakage of 3,810,000 cubic feet. How long this could be kept up, he did not know; but they seemed to be setting themselves a standard which would be difficult to live up to. Proceeding to refer in detail to the working in the past year, Mr. Robinson said that 2,295,100 cubic feet more gas had been used for engines, which was a welcome increase, as this was a field with nearly virgin soil. Consumption by cookers had gone up by 809,200 cubic feet, which was eloquent testimony; and it seemed to him that the engagement of a lady last year to instruct consumers, was money well spent. He concluded a long and interesting speech by asking the public to continue to display their loyalty and patience, and promising that they should benefit at the earliest opportunity. The minutes were confirmed.

YEAR'S WORKING AT HEREFORD.

In his first annual report on the Hereford Gas-Works, Mr. W. W. Townsend, the Engineer and Manager, says that, in spite of severe competition, the amount of gas sold during the past year was 125,959 cubic feet more than in the preceding twelve months. The consumption by ordinary meter decreased by 63,660 cubic feet, and that by contracts 425,050 cubic feet; but these decreases were made up by increases of 1,000,220 cubic feet by slot meters, and 214,449 cubic feet by public lamps. The gross profit for the year is £4262, against £4614 in the preceding year. The revenue from the sale of gas by ordinary meters is £274 less, owing chiefly to the fact that the price of gas was lower in the June quarter than in the same quarter of the year previous. Residual products realized £200 less, owing to the fact that less coal was carbonized, and therefore less coke was sold. The price realized for coke was also slightly lower. The profit on fittings was £376, against £274. It has been considered advisable to write down the values of stocks; and this has affected several of the items of expenditure. In order to compare this year's figures with those of previous years, it is necessary to deduct from the apparent expenditure the sum written off stock for depreciation. The gross expenditure shown in the accounts is £16,948. Deducting £925 written off for depreciation, the actual expenditure for the year is £16,023, against £15,774 for the previous year. Coal cost £127 less, though the average price per ton was higher, owing to reduced leakage and better working results. Maintenance of works cost £1856, against £1582. The increase is accounted for by the repairing of the sulphate plant and the Manager's house at the works, and the relaying of the drainage system. Repairs of mains and services cost £207 less. The only other items calling for mention are £61, the cost of the exhibition, and £76 the cost of fixing gas-fires on hire. As to the first, the amount of profit on fittings and the extra revenue for hired stoves which resulted from business done at the exhibition, more than repaid its cost. The cost of fixing hired gas-fires is rather heavy, because the system was started in November last; and the revenue from the hire of the stoves only took effect in the March quarter. He anticipates in future that the amount received for hire will cover the cost of fixing and repairs, as well as depreciation.

The working statistics show that the gas made was 129,492,000 cubic feet; and the coal carbonized 11,743 tons. The make of gas per ton was 11,026 cubic feet, as compared with 10,909 cubic feet in the preceding year. The unaccounted-for gas was 7·9 per cent., as against 8·56 per cent. The number of ordinary consumers is 1756, and of prepayment-meter users 2156; the figures for the previous year being 1730 and 2077 respectively.

Mr. C. Witts, the Chairman of the Gas Committee, in moving the adopting of the report by the Council, said the Committee appreciated the new Manager; and they believed they had selected the right man. The drop of £352 in the profits of the past year compared with the previous twelve months was due to the reduction in the price of gas running for a full year instead of only for three-quarters. Though they had sold 123,000 cubic feet more gas, they had consumed 300 tons less coal. This had been possible owing to the stoppage of the leakages—a thing they had been trying at for some years. The works and plant were now valued at £143,452, upon which they had a loan liability of £32,390; so he thought it would be admitted that they had a very valuable property. Last year they made 11,026 cubic feet of gas per ton of coal, against 10,909 cubic feet the previous year. He would like to mention that on the ordinary meter consumption there was a drop of a million cubic feet, which showed that they were losing some of their best customers. In the past three years the price of gas to ordinary consumers had been reduced 6d. per 1000 cubic feet, which took away a profit of £2500; they had also reduced the cost to users of penny-in-the-slot meters 4d. per 1000 cubic feet, which made up practically the same amount.

Employees' Outings.—We are now in the season of employees' annual outings, and particulars of several have come to hand. The employees of the Richmond Gas-Stove and Meter Company, Limited, had an excursion to Dublin, where they spent Saturday, the 29th ult., pleasantly and profitably in visiting the International Exhibition, the sights of the city, the Company's show-rooms, &c. The employees of Mr. W. Edgar, of Hammersmith, had their outing and sports the same day at Godalming; dinner being served at the King's Arms Royal Hotel. Several prizes given by Mr. and Mrs. Edgar and their visiting friends were keenly competed for. The staff of Messrs. J. & W. B. Smith, of Farringdon Road, went to Clacton-on-Sea on the same day; the party numbering about a hundred. Dinner was provided at the Brunswick Hotel—Mr. W. D. Cork in the chair. The principal of the firm (Mr. J. G. Watkinson) and Manager (Mr. Ferguson) were present.

GAS AND WATER ADMINISTRATION AT BARRY.

Report by Mr. Robert Porter.

A Special Meeting of the Barry Gas and Water Committee was held on Monday of last week, for the purpose of considering a report by Mr. Robert Porter, of Elland, who had been engaged to inquire into the management and general administration of the gas and water undertakings.

The report was a lengthy document, and in it Mr. Porter stated that Mr. F. M. Harris, the Gas Engineer and Manager, afforded every facility for his inspection of the books, works, and district. The site was at a suitable altitude for giving an efficient supply of gas to the district; and the good railway siding accommodation was admirably situated for the receipt of coal and other material. The very low percentage—2½—of gas unaccounted for during the year was sufficient indication that all the Council's distributing plant was in excellent condition. The capital of the gas undertaking was approximately £124,241; being at the rate of £10 6s. per ton of coal used, or £1 2s. per 1000 cubic feet sold. This capital was somewhat excessive; and very careful engineering would be required in the future to prevent the burden increasing. In fact, it was of the utmost importance that strict supervision should be kept on any charges placed to this account. The works were purchased from a Company in 1894. In that year the sale of gas was about 30 million cubic feet; the capital being, therefore, at the rate of £2 2s. 7d. per 1000 feet sold. The increased sale of gas since that year was phenomenal; and having regard to the rapid growth of the district, and the reserve power in some portions, the additions to this account might be deemed satisfactory. During the last eleven years, £21,382 had been taken from revenue account to subsidize some other funds of the Council. Had this sum been applied to the liquidation of the capital burden upon the gas undertaking, the capital would have been reduced to 17s. 2d. per 1000 cubic feet sold, and the annual amount required to pay interest and sinking fund reduced at the present time by £1520. This item alone would have enabled the Council to reduce the price of gas by 3d. per 1000 cubic feet. There appeared to be no justification for the gas consumer having to maintain the gas undertaking, build up a fund to liquidate the whole of the capital in less than thirty years, and at the same time provide a yearly additional sum of £1520 for the relief of the expenditure of other departments. This policy would lead to extravagance in the departments subsidized, and inflate the price charged for gas. The first impression, on casually looking round, was that the works and plant were in a very neglected condition; that the upkeep and repairs had been neglected for some time, and the place was somewhat under-manned. The chief complaint of the Manager was that, at the special request of the Committee, he had to dispense with the labour required to keep the concern in a thoroughly satisfactory condition. The sum allowed for the maintenance of the undertaking in an efficient manner was totally inadequate; and he knew of no concern in the country thoroughly maintained under 6d. per 1000 cubic feet.

Dealing with the carbonizing plant, Mr. Porter said that the retorts were fired with excellent regenerative furnaces, and well equipped with elevators and conveyors for handling the coal and coke, with a view of reducing the cost of labour to a minimum; and the whole benefits accruing from the introduction of this modern plant seemed to be enjoyed by the Council's workmen. The amount of gas produced per 24 hours was 78,000 cubic feet per bed with three men. This quantity was produced in many works under the old method of band-charging; and fully £500 per annum ought to be saved in wages on this account. The workshops were badly kept, and evidence of neglect was apparent. The stores lacked personal supervision, and the rapid growth of gas consumption demanded a reorganization of the governors. The offices and residence were substantial and well arranged. The statement of the finances of the department showed that there was a surplus of £3054; but if the proper sum had been paid on repairs and renewals of works, this would be reduced to £1321. Generally, the capital charges were excessive; and the capital account ought to be closed for some time, and all alterations and extensions paid for out of revenue, so as to place the undertaking on a sounder financial basis. Having regard to the financial burden on the ratepayers, he was of opinion that economy ought to be practised in the matter of public lighting. In fact, this could be effected without interfering with its efficiency. By using incandescent burners throughout, and reducing the lighting hours, the cost to the ratepayers could be reduced by about £800 per annum for gas only. The question as to whether the best coal and best terms were obtained, could be better answered by the Manager and the Committee. The Manager did not favour the use of the coal at present purchased; and the result obtained certainly confirmed his contention.

Mr. Porter's conclusions were as follows: "From the foregoing, it will be observed that I am of opinion that the department is over-capitalized; that there is considerable room for improvement in the management of the undertaking; that the management does not receive the consideration from the Committee that is conducive to successful co-operation. The strained relationship between the Committee and Manager, the unwarranted interference of the Committee in matters of detail, and the utter neglect to act upon the advice given by the Manager in the matter of administration, is responsible for much of the mismanagement. I am of opinion, too, that the administration of the department would be better carried out by an entirely separate Committee (responsible to the Council for the department alone), who, at their meetings, would employ the time in discussing with the Manager the broader question of finance and administration, results obtained (favourable and otherwise), and the best methods of developing the undertaking, instead of drawing up pettifogging rules to govern the conduct of their Manager in the discharge of his duties. Mutual confidence between management and Committee would do much to improve, and put upon a sound basis, this department."

A lengthy discussion took place upon this portion of the report; and the matter was then adjourned for a fortnight, in order that a statement might be prepared by Mr. Harris. This and the report on the water undertaking will then be considered.

GAS AND ELECTRICITY AT SHEFFIELD.

Sir William Clegg and the Gas Company—The Financial Position of the Electricity Undertaking.

It may be remembered that in the course of the proceedings at the dinner of the members of the Incorporated Municipal Electrical Association on the occasion of their recent annual convention in Sheffield, as reported last week (p. 49), Sir William Clegg, referring to the competition to which the electric light undertaking of the Corporation had to submit owing to the low price of gas, suggested that it might be desirable to open up negotiations with the Gas Company with the object of purchasing their concern, "if they could agree upon a price." It was at first thought that this was only a little bit of after-dinner oratory on the part of Sir William; but, according to what transpired at an interview with a representative of a local paper, he brought forward his proposal in all seriousness. It was put to him whether the competition between the Electric Light Department and the Gas Company was the sole reason for it; and he promptly negatived such an idea—remarking that it was merely one of the elements which induced him to throw out the suggestion. He said that he did not advocate the Corporation purchasing the gas-works at once; but he thought the time would come—perhaps in a very few years—when the Council would deem it advisable, in the public interest, to acquire the undertaking, so as to work it in combination with the electric light. Other corporations had both gas and electric light under their own control; and, personally, he considered it could scarcely fail to be advantageous if a similar arrangement could be carried out in Sheffield. "Of course," he said, "I want it to be distinctly understood that, so far as the present management of the gas undertaking is concerned, it could not be in better or more competent hands. The Directors, past and present, have always materially considered the interests of the public, and, without any pressure at all from outside, and entirely of their own motion, have from time to time reduced the price of gas. Any negotiations would have to be absolutely on friendly lines. I make no suggestion at all that we should go to Parliament for the purpose of compelling the Gas Company to sell their undertaking to us. Unless we can persuade the Directors and shareholders to sell voluntarily, it would be a waste of time our pursuing the matter further. Personally, I do not think we should be able to present a case to Parliament sufficiently strong to induce them to grant us compulsory powers of purchase. We tried it many years ago; but we had absolutely no case, and the Parliamentary Committee who heard it struck out the clause without even calling upon the Gas Company to answer the arguments put forward. Nothing has taken place since then to alter the position of affairs; so the arrangement must be quite spontaneous and voluntary, and you must persuade the Directors and shareholders that parting with the undertaking is to their interests as well as to those of the community." Discussing the plan of purchase, Sir William pointed out that this would depend on mutual agreement; but his suggestion would be the adoption of similar principles to those acted upon when the Council acquired the water undertaking. Instead of a huge sum being paid them, the shareholders in the Water Company accepted terminable annuities, redeemable, if the holders of the stock thought well to sell, in sixty or ninety years. The plan had, he said, worked very well indeed in the case of the Water Company; and there was no reason why a similar plan should not prove equally advantageous to the Corporation as well as to the Gas Company. He added: "The scheme that has been floating in my mind, and concerning which I threw out the suggestion, is one worthy, I think, of consideration; but the beginning and the end of it is of the most friendly description so far as the Gas Company are concerned. To carry it out, it must be with their assent and approval. If they fail to see their way to do it, I should not be in favour of trying to compel them." Questioned as to whether municipal control would be likely to have the effect of raising the price of gas, Sir William replied by instancing his policy with regard to the tram service. "We should have to make absolutely certain," he said, "of the payment of all outgoing expenses, and the provision of a contingency fund to meet unforeseen circumstances; but having done that, I should consider the question whether the price of gas could not be further reduced, rather than create very large profits for the relief of the rates. I certainly should not follow the example of Manchester, where the gas consumers have to pay a pretty high figure in order that very large profits can go for the relief of the general rates. I call that bad municipal policy." In conclusion, he cited the success of the tramways and the water-works as two examples of the value of municipalization, and said that if the gas undertaking could be secured, he was convinced that it, too, would prove an exceedingly profitable investment for the city.

Referring last Thursday to Sir William's proposal, the "Sheffield Daily Telegraph" said that, if he really meant to commit his party to it, they would have a rough passage before them. In order that he might start fair, our contemporary put one or two questions to him which it was thought he might be interested to answer. The writer worked out the prices charged by the 39 local authorities in Yorkshire who own gas-works. There are 14 of them charging from 3s. to 3s. 9d. per 1000 cubic feet; 19 charging from 2s. 6d. to 2s. 11d.; and six charging from 2s. 1d. to 2s. 5d. There are none under 2s. 1d. The average is 2s. 10d., which is a good deal more than double the Sheffield price. "It is obvious, therefore," says the writer, "that municipalization would confer no benefit on the community so far as price is concerned. Nor can it be claimed that we must purchase the undertaking in order to prevent a rise in prices. Parliament has safeguarded our interests in that respect. In the first place, the dividend cannot exceed 10 per cent.; and, secondly, if the price went up to that of the average of the Yorkshire local authorities—that is, to 2s. 10d.—the dividend would automatically fall to 9 per cent. If the charge ran up to 3s. 3d. the shareholders would receive only 7 per cent. So that, within certain limits, the shareholders are as keenly interested as are the consumers themselves in keeping the charges down." This is the first matter for Sir William's consideration. The only reason that has so far been suggested for the proposal is that cheap gas is too keenly competitive with electric light. The position seems to our contemporary to be this: Sir

William says to the Gas Company: "Our electric light cannot compete with you because your gas is so cheap. Kindly raise your prices. If not, we may have to buy you out, so that we can raise them."

Speaking of the electric light, there seems to be something mysterious about the finances of this undertaking which ought to be explained at the meeting of the City Council to-morrow. Attention has already been called to the matter by two of the members; but without success. They will, however, renew their efforts to clear up the mystery. Put concisely, the point is this: According to the last published abstract of the accounts of the Corporation, the salaries paid in the Electric Lighting Department amount to £5201 a year; but in the electric lighting accounts just issued for the year 1906-7, only £1348 is charged to salaries. What about the remaining £3853? In the published accounts, the item of "Salaries of General Manager, Deputy Manager, Secretary, and clerical staff," stands at £1348; but the salaries of only the three officials named amount to £1425, or £77 more than the above total. Against the £1348 purporting to cover the whole of the salaries of the department, a sum of £5201 was actually paid. An explanation of this discrepancy will be sought to-morrow. In the meantime, an announcement has been made which, if carried into effect, will deprive the electric light undertaking of its most ardent supporter. The Lord Mayor, who is the Chairman of the Electric Light Committee, has requested the Town Clerk to intimate to the City Council that he has tendered his resignation; and he has declined to give any explanation for taking this step until he can do so in the City Council.

ELECTRICITY SUPPLY IN LONDON.

London County Council and their Bill.

At the Meeting of the London County Council last Tuesday, the Parliamentary Committee presented their report upon the circumstances leading up to the rejection by the Hybrid Committee of the House of Commons of the Electricity Supply Bill. A summary of the report appeared in the "JOURNAL" for the 2nd inst. (p. 49). The Committee recommended—"That, in the opinion of the Council, it is a matter for deep regret that the London County Council (Electricity Supply) Bill, 1907, has been rejected, thereby depriving the elected representatives of Municipal London of the opportunity of securing the provision of a cheap supply of electricity subject to public control." Mr. W. Peel (Chairman of the Committee) moved the adoption of the recommendation. Mr. H. Gordon moved, as an amendment—"That, with a view of ascertaining what steps should be taken to place again before Parliament a comprehensive scheme for the development of electricity for London and adjoining districts, the Highways Committee be instructed to convene a conference of the various Local Authorities concerned, and to report the results of such conference to the Council as soon as possible." He said the proposals contained in the Bill were most anomalous and almost without precedent, and could not in any sense be said to constitute a comprehensive scheme as asked for by the Committee of 1906. Parliament was amply justified in rejecting the Bill. One of the most regrettable features of the inquiry was the spending of public money by one public authority in opposing another; and he thought the best way to prevent this in the future was to attempt to come to some arrangement with the Local Authorities round London. Mr. W. C. Johnson seconded the amendment. After some discussion, the amendment was lost, on a division, by 77 votes to 41—a majority of 36. The recommendation was thereupon carried.

Financial Difficulties of Borough Councils.

At the Meeting of the Shoreditch Borough Council last Tuesday, the Lighting Committee reported that they had inquired into the working and financial position of the electric light undertaking. They found that in 1897, when the streets were entirely lit by gas, the cost of public lighting was £6244; whereas last year it was £13,295. Of the latter sum, £9212 was spent for electricity. The Committee recommended that the illuminating power of the arc lamps in 24 streets should be reduced by 20 per cent., which would effect a saving of £720 per annum. The Committee went on to say that, as regards depreciation, they were of opinion that the redemption of debt account or sinking fund payments could not be regarded as equal to a depreciation fund, unless the life of the plant coincided with the term of repayment; and as the term of nearly all the loans at Shoreditch was 42 years, the department had not, up to the present, accumulated sufficient funds to meet the requirements of a depreciation fund. Every effort should be made to build up a reserve fund for this purpose. In the course of the discussion which ensued, Mr. Sherratt pointed out that the reason why the undertaking had not been successful was, in the first place, because the gentlemen who composed the first Lighting Committee did not know the value of money, and knew nothing about electricity. Another reason was because most of the members of the Committee had to work for their living, and could not devote sufficient time to the duties devolving upon them. Moreover, it seemed that gas was really cheaper than electricity. The report and recommendations were adopted.

In his report on the audit of the accounts of the Islington Borough Council, Mr. A. Carson Roberts, the District Auditor of the Metropolitan Boroughs, says the charge made for electric current distributed to the public lamps, apart from the cost of providing or maintaining the lamps, &c., is at the rate of 3·31d. per unit, or about twice as high as the average amount charged in other Metropolitan Boroughs. At the meeting of the Borough Council last Wednesday, the Finance Committee reported, in regard to these adverse comments by the Auditor, that they were fully in accord with the views formerly expressed by him that the charges for current supplied for street lighting were greatly in excess of what was fair and reasonable, and that the undertaking was thereby heavily subsidized by the general rate. They were further of opinion that so long as this state of affairs existed no reduction in the charge for private lighting should have been made, unless accompanied by a corresponding reduction in the charges for street lighting, altogether apart from any question of increased consumption. The Committee therefore held that the reduction made by the late Borough Council for private lighting was not justified. The Committee further endorsed the suggestion by the Auditor that a charge should be made on the electricity revenue in respect of the services of the Town Clerk, Borough Treasurer, and Cashier. The Committee went on to say that the accounts showed that the so-called electricity reserve fund of £13,306 did not represent more than was necessary for the purposes of working capital; and they were of opinion that it was desirable that this fund should be so employed, instead of additional loan capital being raised for the purpose. Until the amount of revenue balances was in excess of that required for working the undertaking, it was impossible to create an invested reserve fund.

METROPOLITAN WATER BOARD.

The Financial Statement.

At the Meeting of the Metropolitan Water Board last Friday—Sir MELVILL BEACHCROFT in the chair—the annual financial statement was submitted.

Lord WELBY, the Chairman of the Finance Committee, said that last year he reported to the Board that they could not state definitely the result of the finance for the year 1905-6, but they expected a surplus of £11,567. The audited accounts showed one of £11,838. In regard to the year 1906-7, they estimated the income at £2,814,510, and the expenditure at £2,782,060; leaving a surplus of £32,450. The estimates as originally presented provided for an expenditure of £2,765,017; and supplemental votes of £17,043 brought the expenditure up to £2,782,060. The actual result gave an income of £2,837,550, and an expenditure of £2,804,090; leaving a surplus of £33,460. These figures had not been finally passed by the Auditor; but he thought he could assure the Board that they would be approximately correct. A comparison of actual results with the original estimates showed an increase on expenditure of £39,000, against an increase of income of only £23,000. This difference was serious when they considered the small margin of income over expenditure at their disposal; and the Finance Committee hoped the executive committees would endeavour to confine within the narrowest limits additional expenditure beyond that provided in the estimates. He then drew attention to the result of their finance during the period during which the Board had been responsible for the supply of water to the Metropolis—viz., 2¾ years from June, 1904, to March, 1907. On the first broken year to March 31, 1905, there was a deficit of £9550; the second year gave a surplus of £11,838; and for the third year they expected a surplus of £33,460—resulting in a net surplus over the whole period of £35,748. The sum they considered should be payable every year towards the liquidation of debt was £83,000; and up to the present the amount which might be so applicable was only £12,000 a year. The Board had, in addition, set aside out of revenue £20,950, the statutory sinking fund on the new debt which the Board had incurred since they came into power. As to the estimates for the current year, it was reckoned that the income of the Board would be £2,906,420—an increase of £92,000 compared with that for 1906-7; and the expenditure at £2,896,060, or an increase of £114,000. The surplus for the current year was only £10,360. A contingent provision of £11,150 was made for the first time in the estimates to meet supplemental expenditure; but the Board would have observed the large amount of supplemental expenditure incurred in 1906-7, amounting to nearly £40,000. This was an ominous feature in the Board's finance; and it was evident that if great care were not taken by the executive committees in refusing supplemental expenditure, a deficit—perhaps a heavy one, and in all probability a permanent deficit—was unavoidable, with its necessary consequence of a charge on the rates. The debt of the Board on March 31, 1906, was £47,539,713, and at March last £47,945,349—an increase of £355,636. The amount of capital expenditure required for 1907-8 was estimated at £933,000, against £985,000, the capital expenditure incurred up to March 31, 1907. Comparing the financial situation of the Board with that of the Water Companies in 1903-4, the last year of their administration, Lord Welby stated that, whereas the income of the Companies in the year named was £2,669,302, that of the Board for the current year was £2,906,420—an increase of £237,118 in four years. The expenditure of the Companies, including dividends, directors' fees, &c., was £2,669,302, the same as their income; and the estimated expenditure of the Board for 1907-8 was £2,896,060, which was an increase in four years of £226,758, or about £10,000 less than the increase of income during the period. The cost of the Companies' staffs was £154,700; while the Board's expenditure on this account for 1907-8 was estimated at £132,450—a decrease of £22,250. In conclusion, His Lordship said that, though he did not consider the statement was unsatisfactory, it was one which should impress upon the Board the necessity for very careful administration of their finances.

The estimates were approved.

The Works and Stores Committee presented, in the usual tabulated form, particulars relating to the supply of water in the Metropolis in the month of May. They included the following figures: Average daily supply of water, 218,787,000 gallons; number of houses supplied, 1,064,513; estimated population, 6,911,506; mean supply per head per day, 31·6 gallons; water in store in impounding reservoirs at the end of the month, 8733 million gallons, against 7045 millions at the corresponding time last year.

Colchester Water Supply.—At the meeting of the Colchester Town Council last Wednesday, the Water Committee submitted the report of the Auditor (Mr. R. L. Impey, F.C.A.), who stated that the accounts showed a profit on the past year's working of £2320, compared with £2992 the previous twelve months. The profit, added to the balance brought forward (£2747), made a total of £5067. From this, a contribution of £2550 had been carried to the urban district rate; leaving a balance of £2517 to be carried forward.

MANCHESTER CORPORATION WATER SUPPLY.

The Capacity of the Works and the Demands upon Them.

After a lapse of about thirteen years, the members of the Manchester City Council recently visited the water-works at Lake Thirlmere. On arriving at Windermere, they were conveyed to the Prince of Wales Lake Hotel, where luncheon was served. The subsequent journey to Thirlmere was broken first at the settling-pools on the line of the aqueduct through which the water is carried to Manchester, and again over Dunmail Raise at the straining-well at Wythburn. The operations going on there were fully explained by officials of the Water Department, who acted as guides during the journey. Afterwards, passing over the roads on the east side of the lake, a halt was made on the edge of the large area of land known as Shoulthwaite Moss, which is gradually being reclaimed by the Corporation, and by a system of complete drainage has already been transformed from useless mossland into fairly fertile pastures. The embankment at the north end of the lake was also inspected, together with the overflows, waste-water tunnel, and watercourse, gauge-basin, and valve-houses, and all the arrangements for delivering the compensation water from the lake into St. John's Beck. The quantity of water discharged into St. John's Beck before the diversion of the additional drainage area into the lake was stated to be 4,126,425 gallons in 24 hours. When the lake has been raised to the full extent of 50 feet, its area will be 793 acres, and its capacity 8135 million gallons.

On the return journey, dinner was provided at the hotel. Sir Bosdin Leech, on behalf of the Water Committee, welcomed the visitors, and expressed the hope that members of the Council who were not associated directly with the Committee would have gained some knowledge of the undertaking under their supervision. After a reference to the history of the early water supply of Manchester, he went on to say that it was sixty years since the Corporation first undertook the supply of water to the city. Before that, the service, such as it was, was in the hands of the Manchester and Salford Water Company, who delivered about 3 million gallons a day, obtained from the drainage-ground of the Gorton reservoirs, and supplemented by a supply from the Stockport Canal and a well, and a further supply from the River Medlock at Holt Town. These works were acquired by the Corporation, and had cost £533,561. Knowing the insufficiency of the supply, the Corporation obtained powers to carry out the works at Woodhead. The supply from this source was first delivered to the town in 1851. The consumption per day at once commenced to increase, and grew at a rapid rate, till in 1855 it was 8 million gallons per day. The completion of the works at Woodhead led up to the construction of the large service reservoirs at Audenshaw in 1875; thus finishing the Longdendale supply, which had cost £2,835,000. Ullswater and Haweswater were first suggested as a combined scheme with Liverpool for increasing the supply. But this idea did not find support; and in 1876 it was decided to adopt Thirlmere as an independent source for Manchester, and, in connection with the scheme, to purchase the entire watershed of 11,000 acres. By way of showing how the demand for water has increased since the supply was undertaken by the Corporation, Sir Bosdin Leech gave the following figures:—

	Consumption. Gallons per Day.	Annual Revenue.
1860	11,000,000	£71,507
1870	15,000,000	130,340
1880	18,000,000	196,696
1890	22,500,000	232,675
1900	32,000,000	284,944
1906	37,000,000	362,571

The delivery of water from the lake was, he said, divided into five instalments, each of 10 million gallons a day. Two of these were now available; and the expenditure on the works had reached about £3,500,000. The lake had been raised 35 feet above its original level, and when the entire works were complete the total yield would be 50 million gallons a day. The works were opened and the first instalment of water was delivered to Manchester in October, 1894. The population now supplied reached about 1,200,000 persons.

LIVERPOOL CORPORATION WATER SUPPLY.

Chief Engineer's Annual Report.

We gather from the annual report of the Chief Water Engineer of the Liverpool Corporation (Mr. Joseph Parry, M.Inst.C.E.) that the total volume of water delivered from the works of the Corporation during the year 1906, including statutory compensation waters to rivers in Lancashire and Montgomeryshire, was, in gallons, 17,777,440,000; in cubic feet, 2,848,948,000; in tons, 79,364,000. The consumption of water within and around the city amounted to 9,643,087,000 gallons, compared with 9,854,442,000 gallons in 1905; and the quantity supplied outside the compulsory district was 186,580,000 gallons, against 189,130,000 gallons to Chorley, and 971,379,000 gallons against 781,822,000 gallons to other localities. The total figures were thus 10,801,046,000 gallons, against 10,825,394,000 gallons. The sources of supply were: Vyrnwy, 5,759,995,000 gallons; Rivington, 3,785,644,000 gallons; and wells, 1,216,461,000 gallons—together with 38,946,000 gallons of salt water. The additional number of new houses and other new premises supplied with water in the Liverpool district during the year was 3463. The number of houses pulled down or from which water was withdrawn was 975; leaving a net number of 2488 additional water tenants. The total number of tenants on the rent-roll of the water account at the end of the year was 195,535. The total length of additional distributing and fire mains laid was 13 miles; and the number of new hydrants fixed was 341, as well as four others which were substituted for fire-plugs, The total number of fire hydrants in the compulsory area is now 11,646. There are also still remaining 824 of the old-fashioned fire-plugs, which are being gradually replaced.

With respect to the quality of the water, monthly chemical examinations of samples taken from the several sources of supply were made by Professor J. Campbell Brown; and bacteriological analyses were made by Professor Sir Rubert Boyce, F.R.S., at the Thompson-Yates Laboratories of Liverpool University. Professor Boyce's report is to the effect that the examination showed that the very great bacterial purity of the water supplied to Liverpool had been well maintained. During the year, 25 special examinations were made of the Rivington water, and of about 60 samples taken from the surface of the strainers in the tower at Lake Vyrnwy and from the lake itself—forming part of an investigation as to the origin and character of the deposits found in the aqueduct between Vyrnwy and Oswestry. As soon as the investigation has been completed, a full report is to be laid before the Water Committee.

The total capital expenditure on the water-works to Dec. 31 last was £6,397,674, of which £578,684 was spent in respect of the Harrington and Bootle Companies' works; £71,056 on the Green Lane works; £1,113,374 on extensions of home works (wells, service reservoirs, and mains); £1,700,136 on the Rivington works; £30,254 on the Chorley works; and £2,904,170 on the Vyrnwy works. The income for the year amounted to £333,382, made up of £70,632 from domestic water-rents, £101,599 from the public water-rate, £101,140 from trade and miscellaneous supplies and receipts, £33,404 from shipping supplies, £21,133 from supplies to local bodies, and £5474 from the Chorley works.

Referring to applications for supplies in bulk, Mr. Parry remarks that in the twenty years that have elapsed since the passing of the Act of 1887, very few applications have been received for temporary supplies from places outside the Liverpool area. When communities are short of water, they naturally want to go to a source on which they can permanently rely, not only because of the vital importance of the subject, but also because of the increasing difficulty and expense of procuring new supplies in a country which has a growing population. At the same time, the risk of Liverpool terminating any agreement made (under the section reserving to the Corporation the right to determine the same on giving such notice as they think proper—not being longer than five years), is exceedingly remote. Liverpool is now supplying more than a million people with water. The total number of supplies in bulk from the Rivington and Vyrnwy works is 43, and a list of them is given in an appendix to the report. An important question has arisen in connection with the supply to the town of Chorley, which has outgrown the resources of the works authorized by Parliament; and it has been necessary, in order to maintain a constant service, to give assistance from the Liverpool reservoirs at Rivington. The population of Chorley has more than doubled since the undertaking was acquired, and the demand for water is rapidly increasing. Plans for extensions and reconstructions are in hand.

NEW WATER-WORKS FOR LOUGHBOROUGH.

Last Wednesday, the new storage and filtration works which have just been completed, at a cost of about £6000, for the Loughborough Corporation, were formally opened. It was intended that the ceremony should be performed by Mrs. J. Cartwright, the wife of the Chairman of the Water Committee; but, owing to unfavourable meteorological conditions, she could not leave her carriage, and had to enlist the services of a deputy in the person of her husband. Nevertheless, a numerous and representative company accepted the invitation issued by the Mayor (Alderman T. Mayo) to be present. Leaving Nanpantan, the party drove to the site of the reservoir, which has been constructed to impound 500 million gallons of water. On arriving, they partook of "high tea," under the presidency of the Mayor, at the close of which some particulars of the works were furnished by Mr. F. W. Hodson (son of the late Mr. George Hodson), under whose supervision they have been carried out. He said they had now increased their daily supply to 2,300,000 gallons, available from the Blackbrook and the Nanpantan works; and increased filtration accommodation was therefore an absolute necessity. It had always been considered inadvisable to divide the filtration, and for this reason they had added the new beds to those already in existence. For this purpose $2\frac{3}{4}$ acres of land had been purchased; and each of the two new filter-beds was as large as two of those originally provided. The new beds were 78 feet long and 75 feet wide, with an area of 650 square yards. In addition, a large pure-water tank had also been built, having a capacity of upwards of 280,000 gallons. This was part of a scheme which had been formulated to deal with the whole of the water as the requirements of the town grew. When completed, there would be in all eight filters. Everybody knew how wet, cold, and miserable the season had been; and yet during the eight months they had been storing at the reservoir they had had less than a normal flow in an average season. They found that only one month—June—had sent down the stream into the reservoir a quantity of water more than was due to the month. It was the winter flow at Blackbrook which supplied the water for storage purposes. This was a period during which, as a rule, they obtained 75 per cent. of the year's flow; and during the months of December, January, February, and March they were considerably below the average. In fact, owing to the deficiency in these months, they were 25 per cent. short of their expected total. They had anticipated that the reservoir would be overflowing in April last; but, instead of this being the case, they were still requiring a considerable quantity of water.

PLYMOUTH CORPORATION WATER UNDERTAKING.

The Annual Visit to the Works.

The members of the Plymouth Corporation, together with the principal officials and other persons, assembled at the storage reservoir at Burrator last Wednesday, on the occasion of the annual "Fyshynge Feast." Attention was drawn to the fact that a number of minor improvements had been carried out during the year, chiefly at the

intake of the reservoir. As is customary, the party assembled at the intake and drank in water from the reservoir "to the pious memory of Sir Francis Drake," the constructor of the leat which was the beginning of the water-works; and then in wine the toast: "May the descendants of him who brought us water never want wine."

Later in the day, there was a dinner at which the Mayor presided. Mr. C. H. Tozer, the Chairman of the Water Committee, congratulated the town on the possession of a magnificent storage reservoir; and referring to the works which had been carried out during the year, said that the continuous record which was being obtained at the gauging station would be of great use if any further reservoir works should be contemplated. They had abundance of water in the reservoir—sufficient, indeed, for the supply of Devonport and Stonehouse and the surrounding districts as well as Plymouth. Mr. F. Howarth, the Water Engineer, gave some statistics as to the progress of the undertaking. The income was still on the up-grade, and amounted last year to £32,000; the increase in the past seven years having been £7478. On the other hand, the expenditure was decreasing; and there had been a saving on maintenance and management during the past year of £460. The gross profit was £22,306—an increase of £567; while the interest and sinking fund amounted to £17,581. This left a net profit of £4725—an increase of £711. In the last seven years, the profit had augmented by £1514. The total length of mains was 130¼ miles; the extension during the past year amounting to 2⅓ miles. The new supplies added numbered 745; and the total number was about 20,000. Though progress was being made with the checking of waste, the consumption was still high. The total was 5,600,000 gallons per day, compared with 6,250,000 gallons daily with a smaller population seven years ago. This represented a saving of about 8 gallons per head per day; but the waste of water still amounted to between 10 and 11 gallons per head.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The annual general meeting of the Hawick Gaslight Company was held yesterday—Mr. R. Noble, the Chairman, presiding. In their report, the Directors stated that they regarded the statement of affairs and balance-sheet as most satisfactory. They had recently gone over the works, and found them to be maintained in a state of efficiency. Contracts for the supply of coal for the ensuing year had been entered into on favourable terms. They recommended that the price of gas be retained as at the present—2s. 6d. per 1000 cubic feet—and that the rebate on prepayment meters be 4d. in the shilling, as at present. The Chairman said he thought the shareholders had every reason to be gratified at the result of their year's work. Although the coal account was about £100 more than in the previous year, they had been able to pay their usual dividend—10 per cent.—and to carry over £1000 to help the current year's profits. This was very satisfactory, considering the great advance in the price of coal. They had put in a new bench of retorts, at a cost of £2000. This was being paid entirely out of revenue, as it was a replacement of an old bench. They would be able now to get more gas out of the same quantity of coal than they did with the old retorts. With regard to cooking-stoves, the Directors gave very liberal terms for fitting them into the houses—in fact, practically fitting them free. They also fitted gas-fires free, and their Manager—Mr. W. S. Smith—would be pleased to give advice in cases where supply was deficient or not satisfactory. The report was adopted.

The annual meeting of the Galashiels Gaslight Company was held on Tuesday. The Chairman—Mr. James Dickson—in moving the adoption of the report of the Directors, a summary of which has already been given in these "Notes"—said it was very gratifying to be able to present such a satisfactory report and balance-sheet to the shareholders. The quantity of gas manufactured had been a record one, having exceeded the previous year by nearly 4 million cubic feet. The profit had correspondingly increased, and enabled the Directors to recommend the payment of a dividend of 10 per cent., free of income-tax, and to carry forward about £200 to the reserve fund. The Directors had found it necessary, owing to the very serious rise in the cost of coal, to make an advance of 2½d. per 1000 cubic feet in the price of gas; and it was owing to some contracts having been placed before prices rose so much that they had been able to fix the price of gas so low as 2s. 11d. per 1000 cubic feet. Were the year's supply of coal to be contracted for now, the advance in the price of gas would be considerably more. The low-level siding at the works was completed a few months ago, and was working most satisfactorily. Much of the success of a Company like theirs depended upon those at the head of affairs; and he was certain that they all felt that in Mr. Francis Scott they had one who knew his work thoroughly, and who did it most efficiently He was well supported by Mr. A. Scott, his father, who for many years proved himself a capable and careful Manager of the Company. The report was adopted, and the dividend recommended agreed to.

The Aberdeen Corporation on Monday resolved that the salary of Mr. Charles E. Smith, the Assistant-Manager, should be increased by £25 a year—a similar increase to be made next year.

The Lochgelly Gas Company, Limited, held their twenty-second annual meeting last night. The Directors reported a profit on the year's working, including premium on new shares, of £848. A dividend at the rate of 6 per cent. was declared, and £248 was carried to the current year's account. The price of gas was raised from 3s. 9d. to 4s. 2d. per 1000 cubic feet. The make was 13,399,220 cubic feet—an increase of 3,319,070 cubic feet.

The annual report of the Directors of the Stirling Gaslight Company shows the net profit for the year, after deducting £1000 from revenue to account of the replacement of the retort-bench, to have been £4825. Dividends at the rate of 9s. 5·5134d. upon the capital shares

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of £5 7s. 6d., and on the new ordinary shares at the rate of 11s. per £10 share, are recommended; being at the same rates as were paid last year.

The Dalry, Ayrshire, Gas Company, have raised the price of gas by 5d.; making it 4s. 7d. per 1000 cubic feet.

The Alyth Gas Company have paid a dividend of 6 per cent., after writing off a substantial sum for depreciation. The price of gas has been retained at 5s. 5d. per 1000 cubic feet for lighting purposes, and at 5s. for cooking and motive power.

A fuller statement regarding the Kirkcaldy Gas Company, Limited, shows that the quantity of gas manufactured during the year was 145,600,000 cubic feet—an increase over the previous year of 4,372,000 cubic feet—and that the profit amounted to £4184.

The shareholders of the Kinross and Milnathort Gas Company, at their annual meeting on Wednesday, advanced the price of gas by 2½d.; making it 4s. 4½d. per 1000 cubic feet.

The Motherwell Gas Company held their annual general meeting on Thursday, at which a dividend of 10 per cent. was declared. The shareholders adopted the Memorandum and Articles of Association for the Limited Liability Company which is to be incorporated. At present the capital is £37,500. This is to be increased to £60,000, in £1 shares—the present shareholders to receive a bonus of half-a-share for each share held by them at present.

The Bellshill Gas Company, Limited, held their annual meeting on Thursday. The Chairman—Mr. W. Neilson, J.P.—said it was gratifying to observe that the Company's operations were still extending. The make of gas for the year was 26,943,000 cubic feet—an increase of 2,797,000 feet on the preceding year. They had been obliged to erect a new and extended retort-bench, in consequence of which a considerable sum was spent during the year. A dividend of 5 per cent., free of income-tax, was declared. Owing to the large increase in the cost of coal, the Directors felt themselves obliged to raise the price of gas by 2½d. per 1000 feet; making it 3s. 4d. The report was adopted.

The Anstruther and Cellardyke Gas Company, Limited, held their annual meeting on Wednesday. The profit for the year was reported to have been £942. A dividend at the rate of 5 per cent. was declared, absorbing £250; £368 was added to the depreciation fund; and £324 was carried forward. The quantity of gas consumed during the year was 11,045,000 cubic feet; and the revenue from gas was £2092.

The Coupar Angus Gas Company met on Wednesday, and unanimously adopted recommendations by the Directors as follows: (1) That a dividend of 5 per cent. be declared; (2) that £50 be set apart for repayment of debentures; (3) that there be no alteration in the price of gas meanwhile; and (4) that an honorarium of £10 and an increase of salary be voted to the Manager—Mr. W. F. Vernon—for his services. During the year plant for the manufacture of sulphate of ammonia was put down; and as there is considerable local demand for the product, the venture has proved a great success.

At the annual meeting of the shareholders of the Pittenweem and St. Monance Gas Company, it was reported that the consumption of gas during the year amounted to 6,374,350 cubic feet, the revenue from which was £1328. A dividend of 10 per cent. was declared—the same as last year.

A Select Committee of the House of Commons, presided over by Major Seely, has this week been considering the Renfrewshire Upper District (Eastwood and Mearns) Water Bill, the object of which is to authorize the purchase by the Renfrew County Council of the Busby Water Company, and to extend the existing water-works of the Company. It will be remembered that the Corporation of Glasgow promoted a Bill for the same purpose; but it was thrown out by a Committee of the House of Lords. The Corporation, holding that they are bound, by their Act of 1855, to supply water in the Busby area, carried their opposition to the House of Commons. In the course of the proceedings, Mr. Beveridge, on behalf of the Corporation, made an offer to supply water from their Gorbals water-works, as far as Newton Mearns, at a domestic rate not exceeding 1s. in the pound, and to purchase the Company. The County Council, it had been shown, could not supply water for less than 1s. 6d. in the pound. The offer was not accepted; but after the return of the parties to Glasgow—the inquiry having been adjourned for a week—an agreement was come to upon the lines of the offer. Part of the area is within the county of Lanark, and terms have yet to be come to with the Lanark County Council; but it is believed that this will be easily accomplished. The Corporation of Glasgow are to promote a Bill next year to authorize the arrangement.

The revenue of the Dundee Water Commission for the year ending May 15 amounted to £54,849, of which £17,857 was derived from the domestic rate, £4601 from the public rate, and £32,391 from supplies by meter. There was a surplus of £2825 on the past year's working. During the year, £14,993 was expended in the uplifting and re-laying of portions of the old Lintrathen main, and £10,872 was the cost of taking over the Carnoustie plant. The Commission have reduced the domestic rate from 9d. to 7½d. in the pound, and retained the other charges at the same figures as last year.

Cramped Gas-Works.—At the last meeting of the Hebden Bridge Urban District Council, Mr. T. B. Chambers, in moving the adoption of the report and balance-sheet of the Hebden Bridge and Mytholmroyd Gas Board, said they had had a successful year; but they were hampered at the gas-works, which were about half the size they should be for economical working. They could stock only seven days' supply of coal and one day's supply of gas; and if they had some dark days they would be on their "beam ends." They really should go in for another site. They had doubled their output of gas; and he did not know a place where the same quantity (75 million cubic feet per annum) was made on so small an area. Praise was accorded to the Board and to the Engineer and Manager (Mr. E. J. Wellens) for the way in which they had carried on the works.

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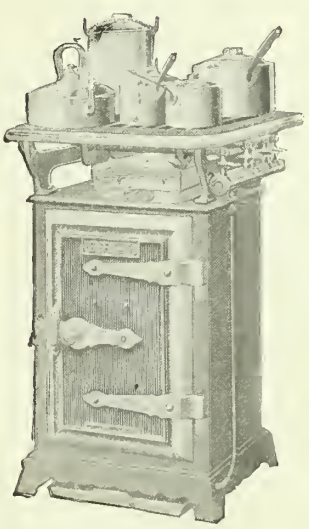

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 6.

Sulphate of Ammonia.

There has been no special feature in the market upon which to comment. Supplies have not been over-abundant, makers having as far as possible cleared out their stocks within the first half of the year; but, on the other hand, demand has rather slackened, so that the opening prices have not been improved upon. The closing quotations remain £11 15s. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. In the forward position, no important first-hand business has transpired; makers being firm in their attitude, while buyers remain indifferent. Further speculative selling is, however, reported from abroad at a discount on makers' prices.

Nitrate of Soda.

This article is steady at 11s. per cwt. for ordinary, and at 11s. 3d. or refined quality, on spot.

LONDON, *July* 6.

Tar Products.

The market for tar products is quiet, and there is little business doing, with the exception of creosote, which remains firm. In pitch, the season is now practically over, and there probably will not be any more shipping done until next September. If immediate shipment were guaranteed, one could purchase at 26s. in London to-day; but as this is out of the question, the price is purely nominal. For forward delivery, makers are very firm in their ideas, and will not consider anything under 30s. On the east coast, makers will accept 25s. to 25s. 6d. for prompt delivery; but for forward, 28s. 6d. to 29s. 8d. appears to be about the ruling figure. On the west coast, a reasonable figure would be accepted for prompt delivery, as several makers will have to carry forward a great deal more than they like; and pitch has been freely offered at 24s. without success. For forward, 27s. to 28s. is the price generally quoted. Business on the Continent is still difficult, as consumers refuse to pay the equivalent of figures asked on this side, and their ideas are very slightly in advance of to-day's prompt figures, so that they give dealers no inducement to sell to them. In South Wales, from 30s. 6d. to 31s. has been accepted for waterborne pitch, both to the end of the present year and also over the next twelve months. Creosote is very firm all round, though there is no alteration in prices. London manufacturers quote from 2⅞d. to 3d. per gallon, for both prompt and forward delivery, and do not appear to be anxious to sell, even at this figure, any considerable quantity. In the Midlands, the figures may be taken at 3d. per gallon all round; while in the North, from 2½d. to 2¾d., according to quality and period of delivery. Benzol, 90 per cent., is very quiet, and sales are difficult to make; and to place any quantity one would probably have to discount even the present market to a considerable extent. Toluol is weak, and it is possible to buy at out-ports at 11d. per gallon, and in London at 1s. Benzol, 50-90's, is not in much demand, and even the low prices indicated by makers are no inducement to consumers to purchase. It is evident that they have large stocks, which will enable them to remain out of the market for some little time to come. Solvent naphtha is very quiet, with the exception of London, where the demand is steady and appears to be about equal to the production of actual London makes. Carbolic acid is in about the same position. Continental consumers refuse to offer more than 1s. 7½d., except at certain picked ports which give them an advance of freight. Manufacturers are, however, well sold, and will not consider anything like this price. Creosote salts and naphthalene are both unchanged, being in good demand, at existing figures. No business of importance has taken place for some little time past in anthracene.

The average values during the week were: Tar, 16s. to 20s. Pitch, London, 26s. nominal; east coast, 25s. to 25s. 6d.; west coast, 23s. 9d. to 24s. 3d. Benzol, 90 per cent., 7½d. to 8½d.; 50-90 per cent., 8¼d. to 9¼d. Toluol, 11d. to 1s. Crude naphtha, 4d. to 4½d.; solvent naphtha, 1s. to 1s. 2½d.; heavy naphtha, 1s. 2d. to 1s. 3d. Creosote, London, 2⅞d.; North, 2½d. to 2¾d. Heavy oils, 3d. to 3⅛d. Carbolic acid, 60 per cent., 1s. 7¾d. to 1s. 8d. Naphthalene, £6 10s. to £12 10s.; salts, 35s. to 40s. Anthracene, "A" quality, 1½d. to 1¾d.

Sulphate of Ammonia.

The market is steady, but without much interest. Dealers appear to be willing to buy at about existing figures for prompt delivery; but up to the present they will not pay the prices asked for forward. The principal London Gas Companies do not care to quote for this year's delivery, being fairly well sold; while for next year they quote £12 5s. Ordinary stuff, however, can be secured on Beckton terms at about £11 13s. 9d. to £11 15s. per ton. In Leith, the demand is still fairly good; and the figures remain at about £12 to £12 2s. 6d. In Liverpool, some good grey was offered at £11 18s. 9d.; and this may be taken as about the ruling price. In Hull, the market is quiet, with not much business. About £11 15s. may be taken as the ruling figure.

Loughborough Gas Supply.—At the meeting of the Loughborough Town Council on Monday week, Alderman Bumpus, in moving the adoption of the Gas Committee's minutes, said the balance-sheet for the past financial year showed a gross profit on the revenue account of £6923.

Another Loan for the Devonport Gas Works.—Mr. J. Buckley, the Gas Engineer and Manager of the Devonport Corporation, reported to the Gas Committee last Thursday that the capital of £35,000 raised for the purchase of gas stoves, meters, and automatic installations had been expended. He said the progress of the undertaking in this direction continued; and he recommended that application should be made to the Local Government Board for sanction to borrow a further sum of £25,000, which he estimated would cover the outlay in the next three years. The Committee decided to recommend the Council to take the necessary steps to raise the loan.

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COAL TRADE REPORTS.

Lancashire Coal Trade.

Trade is being kept up at a high level. Weather influences are all in favour of the coalowner; and the result has been a continuance of orders for house coal. Engine fuel is in strong demand. A steady business is being done in shipping coal. There is no change to record in prices. Exports of coal from the Ship Canal and from other English ports continue to increase; the returns for the six months ending May showing a large tonnage over the exports during the corresponding period of last year.

Northern Coal Trade.

There is a little more irregularity in the northern coal trade; the output at the collieries being now fuller. With, however, a better supply of steamers to take cargo, there seems to be some ease in the home demand; but deliveries on the contracts for export are heavy. Best Northumbrian steams are steady at about 14s. 7½d. to 14s. 9d. per ton f.o.b., second-class steams are 14s. to 14s. 3d., and steam smalls are firm at 10s. to 10s. 3d. Some additional contracts for Sweden have been booked at prices near those quoted. In the gas coal trade there is a good demand, though this is the dullest period of the year in the home trade—the exports being heavy. Durham gas coals for prompt or early shipment vary from about 13s. 3d. to 14s. 6d. per ton f.o.b., according to quality, with a few pence higher quotation for one or two special classes. As to contracts, no very heavy ones have been fixed in the last few days; but in all cases higher prices are claimed. For Barletta, a contract for some 30,000 tons for next year has been closed; and though the price is not officially stated, it is said to be from 13s. 6d. to 13s. 9d. per ton f.o.b. Others may reach somewhat similar figures. The coke market is firm; and good gas coke for export seems somewhat scarce. The quotation is about 17s. per ton f.o.b. Gas coke is being offered for household use at 16s. per ton, unbroken, but delivered.

Scotch Coal Trade.

There is great activity in the coal market, the approaching holidays leading to a rush to obtain supplies. There is said to be little coal available for delivery before the holidays; and until they are over, there is no probability of prices slackening. The quotations are: Ell 12s. 6d. to 13s. 9d. per ton f.o.b. Glasgow, splint 13s. to 13s. 3d., and steam 12s. 6d. to 12s. 9d. The shipments for the week amounted to 348,387 tons—an increase of 36,785 tons upon the previous week, and of 30,909 tons upon the corresponding week of last year. For the year to date, the total shipments have amounted to 7,050,280 tons—an increase of 395,348 tons upon the corresponding period of 1906.

Directors' Fees as Profits.

Upon the above subject, the "Law Journal" makes the following remarks: "Directors have had such a bad time of it in Courts of Equity under the doctrine of fiduciary relationship, that the decision of Justice Warrington in the matter of the Dover Coalfields Extension, Limited, will come as an agreeable surprise. The Dover Company had a large holding in the Kent Collieries Corporation, and, to protect its interests, it wanted to be represented on the Board of the Corporation. Accordingly, the Company transferred certain of its shares in the Corporation to two of its Directors, A and B, to qualify them for a seat on the Board of the Corporation. They were elected and acted as Directors; and, for so acting, they received, in Directors' fees, £800 or £900 apiece. Then the Dover Company was wound up, and the Liquidator said to A and B: 'Hand over that £800 to me; it was a profit which you made by use of the Dover Company's property—*i.e.*, its shares which qualified you—and you must account for such profit to the Company.' Instinctively, we feel that there is a fallacy here; and Mr. Justice Warrington quickly put his finger upon it. The Director's right to remuneration in such a case does not arise from the possession of his qualification shares, but by reason of the contract of service. Such remuneration is not profit at all, in the same sense as dividends or bonuses on the shares are profit; it is payment for work. It would be monstrous if Directors were to do all the work of management, and then the Company were to take from them the fees which they had fairly earned. Companies cannot let out their Directors for hire."

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards sold, under instructions from executors, shares and stocks of several prominent Gas Companies. Parcels of "A" and "C" 10 per cent. stocks of the Barnet District Gas and Water Company, carrying 7½ per cent. dividend, sold at £167 per £100 of stock; "B" 10 per cent. stock of the same Company, on which 6½ per cent. has been paid for the past few years, fetched £145 per £100 of stock; "D" gas and water stocks (7 per cent.), carrying 5¼ per cent., realized £121 10s. for the former and £120 to £121 10s. for the latter per £100. Ordinary "C" stock of the Ilford Gas Company, ranking for a standard dividend of 5 per cent., subject to the sliding-scale, fetched £124 to £125 10s. per £100, *cum div.* at the rate of 6 per cent. per annum. Some "A" stock of the Tottenham and Edmonton Gas Company (standard dividend 5 per cent., but carrying 1½ per cent. more) was sold at £131 to £132 10s.; and some "B" stock (standard dividend 3½ per cent.), at £103 10s. to £107 per £100, *cum div.* at the rate of 5 per cent. A few £10 "B" shares (7 per cent.) in the Sevenoaks Gas Company fetched £15 5s. each. Some consolidated ordinary stock of the West Ham Gas Company, carrying 5⅛ per cent. dividend, was sold at £108 per £100; and some similar stock of the Reading Gas Company, carrying 5 per cent. dividend, at £106. A few new £10 shares in the Worthing Gas Company (7 per cent.) fetched £14 12s. 6d. per share; and some consolidated stock (10 per cent.), £200 per £100. The last lots consisted of a few "A" original £5 shares in the St. Margaret's Gas Company, Limited, on which 6 per cent. dividend has been paid for two years; and they fetched £6 5s. per share. At a recent sale by Messrs. Dann and Lucas, a new issue of £10 shares (7 per cent.) in the Dartford Gas Company was placed at £13 10s. to £13 17s. 6d. per share.

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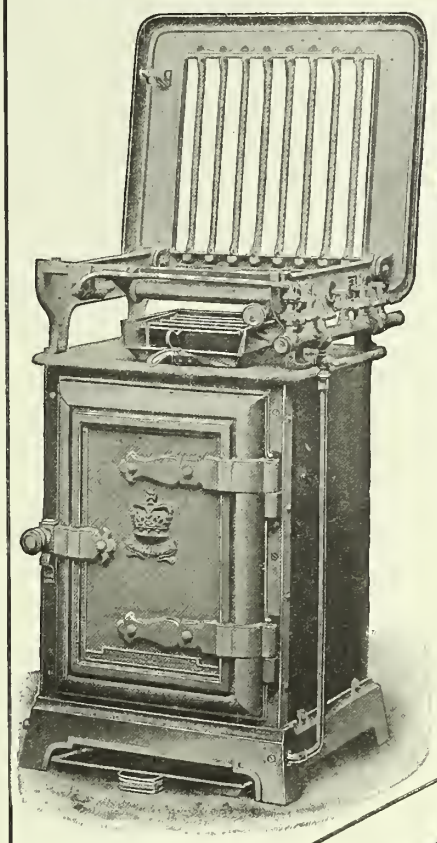

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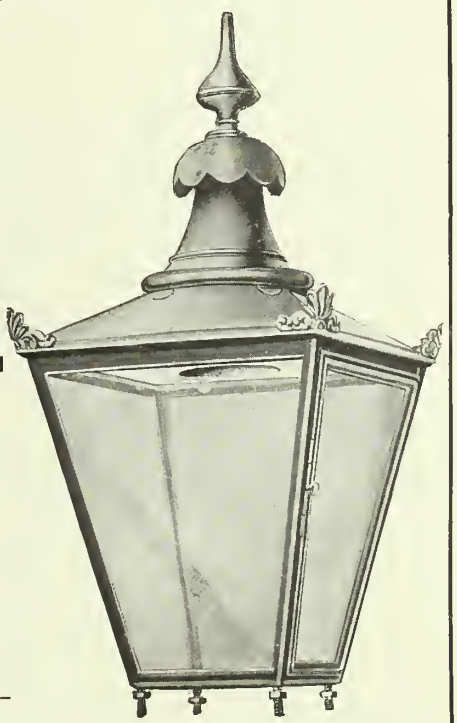

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Ilkeston Corporation Gas Department.

We learn from the Gas Engineer and Manager of the Ilkeston Corporation (Mr. F. C. Humphrys) that the gas made in the year ending the 31st of March last was 103,716,400 cubic feet—an increase of 4,130,700 cubic feet on the make in the preceding year; and the resulting ncome has advanced from £11,678 to £12,304. The return for residuals (chiefly coke) is better, being £4057, against £3933; making a total increase of about £700. The cost of manufacture, owing mainly to the greater tonnage of coal used, advanced from £7153 to £7316. Distribution expenses returned to the normal, and stand at £887. Nearly £200 was added to the account for the repair and replacement of cookers; and with rates and taxes and management at the usual figure, there was a total expenditure of £10,179, against £10,040 in the year 1905-6; leaving a gross balance of £6368, compared with £6168 before. This balance will permit of the necessary larger allowances for depreciation and sinking fund charges, and (with the addition of £143 from the suspense account) provide for the ordinary contribution to the rates. The number of consumers is 4778, of whom 3614 have prepayment meters; being an augmentation to the extent of 340. There are 1623 cookers in use—an increase of 153. The number of orders received at the office from customers exceeded 3700, most of which were dealt with the day they were received. All the works, plant, and mains were renewed where necessary, and generally maintained out of revenue; and Mr. Humphrys says that, considering their limited capacity, they are fairly efficient. The general question of increasing their capacity is being considered by the Gas Committee.

Loans for Ferro-Concrete Constructions.

In the House of Commons, on Monday last week, Mr. Whitehead asked the President of the Local Government Board whether the adoption by local authorities of the method of construction known as ferro-concrete was discouraged by the Board, and whether they required a much shorter period than the normal one for repayment of loans if this method was adopted; whether he was aware that ferro-concrete had been proved, both on the Continent and in the United States, after many years' experience, to be durable and fire-resisting, and that it was about to be used in the construction of the new General Post Office; and whether, having regard to the importance of this question, both to local authorities and those interested in the manufacture of cement, he could see his way to treating loans for purposes involving this method of construction on at least as favourable a footing as those for construction with bricks and mortar. Mr. Burns, in reply, said he was advised that it was doubtful whether ferro-concrete was a suitable material for permanent structural works under all conditions, and consequently there was need for caution in dealing with it. The Local Government Board had had under their notice examples of the failure of works constructed with it. He believed it was intended to use this material in the construction of the new General Post Office; and it was the case that it had been employed for some years on the Continent and in the United States. Its use had not, however, always been successful. He was not at present satisfied that the periods allowed for the repayment of loans for works constructed of ferro-concrete could be properly extended.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

Gas Manager. No. 4794.
Business and Sales Manager. "*Z. G.*" 200, c/o Deacon's.
Chief Assistant-Engineer. Leeds Water Department. Applications by July 19.
Foreman Gas-Fitter. Brighouse Gas Department. Applications by July 20.
Assistant-Manager, Gas and Water. Borough of Barrow-in-Furness. Applications by July 17, 1907.

Situations Wanted.

Sulphate of Ammonia Lead Work. Bond, Warwick Road, Kensington.
Gas-Stove Show-Room. King, 55, Ranelagh Road, Pimlico.
Representative, Gas Lighting Firm. No. 4795.

Plant (Second-Hand), &c., for Sale.

Engine and Exhauster, &c. Riddings Gas Company.
Engine and Exhauster, Meters, &c. Widnes Gas Department.
Purifiers, &c. Galston Gas-Works.
Station Meter. Whittington Gas-Works.
Station Meter, Engine and Exhauster, Purifiers, Scrubbers, Washers, Engines and Boilers, and Other Gas Works Plant. Hastings Gas Company.

Plant (Second-Hand) Wanted.

Scrubbers and Washers. "Gas-Works," c/o Vickers.

Gas-Works, &c., for Disposal.

Kent County Gaslight and Coke Company (in Liquidation).

Stocks and Shares.

Uxbridge Gas Company. July 17.

TENDERS FOR

Coal and Cannel.

Hayling Island Gas Company. Tenders by July 16.
Malton Gas Company. Tenders by July 20.

Concrete (Reinforced) Floors.

Coventry Gas Department. Tenders by July 10.

Oil for Gas Making.

Leeds Gas Department. Tenders by July 20.

Tar and Liquor.

Coventry Gas Department. Tenders by July 10.
Matlock Gas Company. Tenders by July 15.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 86.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.. . . .	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Feb. 28	14	Bournemouth Gas and Water 10 p.c. . .	27½—28½	..	4 18 3
51,810	10	,,	7	B 7 p.c. .	16½—17	..	4 2 4
53,200	10	,,	6	Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	,,	12½	Brentford Consolidated	250—255	+3	4 18 1
300,000	,,	,,	9½	Do. New . . .	188—193	..	4 18 5
50,000	,,	,,	5	Do. 5 p.c. Pref. .	117—122	..	4 2 0
206,250	,,	June 13	4	Do. 4 p.c. Deb. .	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41—43	..	4 13 0
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c. .	119—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c. .	90—93	..	4 16 9
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	11—11½	..	6 1 9
250,000	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95*	..	4 4 3
150,000	20	Mch. 14	8¼	Cagliari, Ltd.	25—27	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	8½—9½	..	4 14 9
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96*	..	4 13 9
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord. . .	109—111	..	4 10 1
1,443,280	Stk.	,,	5$\frac{2}{10}$	Commercial 4 p.c Stk. .	105—108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do. .	102—105	..	4 15 3
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk. . . .	103—105	..	3 16 2
486,090	10	Jan. 31	12†	European, Ltd. . . .	23—24	..	5 0 0
354,060	10	,,	12†	Do. £7 10s. paid	18—19	+½	4 14 9
15,203,110	Stk.	Feb. 14	4$\frac{1}{10}$*	Gaslight and Coke 4 p.c. Ord. . .	94—96	+1	4 11 7
2,600,000	,,	,,	3½	3½ p.c. max. . .	88—90	..	3 17 9
3,799,735	,,	,,	4	4 p.c. Con. Pref.	102—105	..	3 16 2
4,193,975	,,	June 13	3	3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental .	171—174	+1	4 12 0
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c. .	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110*	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A . .	221—223	..	4 9 8
718,100	,,	,,	7	Do. B. .	164—165	+½	4 4 10
144,140	Stk.	Feb. 14	7⅝	Maidstone 5 p.c. . .	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd. .	4—4½*	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb..	100—102	..	4 18 0
250,000	100	,,	4½	4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 9
1,775,892	Stk.	Feb. 28	4⅝	Newc'tle & G'tesh'd Con.	107—109	+1	4 4 10
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	94—95*	..	3 13 8
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd. . . .	140—145	−3	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd. . .	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord. . . .	6¾—7¼	..	4 16 7
796,980	5	Jan. 31	5	Do. 5 p.c. Pref. .	5—5¼	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb. .	94—96	+1	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.. . .	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95*	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd. . . .	12½—13	..	6 3 1
125,000	50	July 1	5	Do. 5 p.c. Deb. .	48—50*	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	245—247	..	4 1 0
209,984	,,	,,	10	Do. B	245—247	..	4 1 0
523,500	,,	,,	10	Do. C	245—247	..	4 1 0
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,350,000	Stk.	Feb. 14	5½	South Met., 4 p.c. Ord.	119—121	+1½	4 10 11
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	82—84	−1	3 11 5
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	157—159	..	5 0 8
605,000	Stk.	Feb. 28	5½	S'th Suburb'n Ord. 5 p.c.	117—121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 10 11
117,058	,,	Jan. 16	5	Do. 5 p.c. Deb. Stk.	125—130	..	3 16 11
502,310	Stk.	May 15	5	Southampton Ord. . .	105—110	..	4 10 11
120,000	Stk.	Feb. 28	6½	Tottenham and Edmonton A 5 p.c. .	123—126	..	5 3 2
398,940	,,	,,	5	B 3½ p.c. .	100—103	..	4 17 1
137,500	,,	June 27	4	4 p.c. Deb.	99—101*	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102*	..	4 13 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	106—108	..	4 12 7
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c. . .	—	..	—
255,636	,,	,,	6½	B 3½ p.c. . .	131—136	..	4 15 7
75,000	,,	,,	5⅗	C 3½ p.c. . .	—	..	—
79,416	,,	June 27	3	3 p.c. Deb. Stk.	77—80*	..	3 15 0
845,872	,,	Feb. 28	5⅛	West Ham 5 p.c. Ord. .	102—105	..	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 1 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103*	..	3 17 8

Prices marked * are "Ex div." † Next dividend will be at this rate.

Public Lighting of Calcutta.—Tenders are being invited for lighting by gas, oil, electricity, or other illuminant, the streets, thoroughfares, &c., of Calcutta. The city comprises approximately an area of 20 square miles, containing about 170 miles of main thoroughfares and 130 miles of smaller streets, besides several squares, markets, latrines, slaughter-houses, &c., which are now lighted by gas and oil lamps. The city is supplied with gas by the Oriental Gas Company.

Increased Gas Consumption in Belfast in June.—The unsettled weather which has lately prevailed, while causing much lamentation on the part of certain classes of traders, was a source of profit to the Belfast Corporation. According to a statement made by Mr. Doran when moving the adoption of the minutes of the Gas Committee at the last meeting of the Corporation, there was an increase to the extent of 10 million cubic feet in the output of gas last month in comparison with the corresponding period of the past year.

The Proposed Purchase of the Crewkerne Water-Works by the District Council.—The question of the purchase of the water-works was again considered by the Crewkerne Urban District Council last Tuesday. The Directors of the Water Company wrote that they could not advise the shareholders to accept the offer made by the Council; their opinion being that the price they had themselves fixed was not more than a fair and reasonable one for the undertaking. They added that they were prepared, up to the 8th of August, to adhere to the terms of their letter to the Council; but after that date they reserved to themselves the right to make such alterations as they might deem advisable. It was pointed out that the difference was between £14,500 offered by the Council and £16,500 and costs required by the Company. It was suggested that if the Company failed to come to terms, the Council would be justified in obtaining a supply of their own. After considerable discussion, it was decided that the Clerk should again write to the Company, suggesting that facilities should be granted for an inspection of the whole water system, machinery, and plant by a competent engineer to be appointed by the Council before they proceeded further with the negotiations.

Messrs. Arden Hill and Co. have just completed installations of "Acme" and slot cookers for the Hirwain Gas and Coke Consumers' Company, Limited, Glamorganshire.

Lord Rosebery on Friday afternoon inaugurated a water service which he has constructed and presented to the village of Cheddington (Bucks.), at an approximate cost of £2000, as a memorial of the late Lady Rosebery.

We have received from Messrs. C. & W. Walker, Limited, a neatly printed pamphlet illustrating examples of the structural steel and cast-iron work they have carrried out. They comprise steel buildings, chimneys, gasholders, oil or tar tanks, and riveted tubes and mains.

We learn from our local correspondent that the passing of the Worthing Gas Bill by the House of Lords was the occasion of great enthusiasm at Goring, where the new works are to be erected. A workmen's procession marched round the village; and there was a large amount of bell-ringing and cheering.

Ever on the alert to extend the use of gas, Mr. R. S. Ramsden, the Assistant Gas Manager to the Burton-upon-Trent Corporation, has issued a neat booklet showing at a glance the prices now in vogue in the borough for gas used for motive power and other manufacturing purposes. They range from 2s. down to 1s. 6d. per 1000 cubic feet, according to quantity.

At a meeting of the Council of the Secret Commissions and Bribery Prevention League last Tuesday, at the London Chamber of Commerce, Sir Edward Fry was chosen as the first President, and the Archbishop of Canterbury, Earl Fortescue, Lord Avebury, Sir W. H. Holland, Sir W. Mather, and Mr. David Howard were elected Vice-Presidents. Mr. David Howard, who presided, reported that the League had made considerable progress, and was obtaining an increasingly influential membership. Mr. R. M. Leonard has recently been appointed Secretary; and the offices of the League have been removed to No. 3, Oxford Court, Cannon Street, E.C.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

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THE Directors having received 190 Applications in reply to their advertisement for MANAGER, beg to THANK all those Gentlemen who applied, and to say that as it is impossible to reply to the whole of them, any one who has NOT BEEN COMMUNICATED WITH will kindly understand that HIS APPLICATION IS NOT ACCEPTED.

W. R. Cooper,
Secretary.

Banbury, July 4, 1907.

GENTLEMAN with large Experience in Gas Lighting requires Position as REPRESENTATIVE in London or Provinces. First-Class References. Salary and Commission.
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WANTED, a Gas Manager for a Gas Company (making about 20 Million Cubic feet) in the Midlands.
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BOROUGH OF BRIGHOUSE.

THE Gas Committee of the Corporation require the services of a First-Class FOREMAN GAS-FITTER, able to repair Gas-Meters, and Experienced in Compo., Fires, Cookers, Slot Installations, Private House Fitting, Incandescent Lighting, &c. The Wages will be 35s. per week; but no allowance will be made for overtime.

Applications, to be made on form which can be obtained from the Gas Manager, Mill Lane Works, Brighouse, and to be accompanied by not more than Three *copies* of recent Testimonials.

Applications to be delivered to me, the undersigned, on or before Saturday, July 20, 1907, endorsed "Gas-Fitter."

By order,
James Parkinson,
Town Clerk.

Municipal Offices,
Brighouse, July 5, 1907.

GENERAL Business and Sales Manager required by Important English Gas Company. Applicant must be thoroughly Competent, Energetic, of good Address, and able to Undertake Large Responsibility. Technical knowledge less essential than Commercial Ability. Good Salary.
Address letters to "Z. G.," 200, Messrs. Deacon's, 154, Leadenhall Street, E.C.

BOROUGH OF BARROW-IN-FURNESS.

THE Corporation invite Applications for the Appointment of ASSISTANT-MANAGER of the Gas and Water Works. Salary, £130 per Annum.

Applicants must be competent Draughtsmen, and have a thorough knowledge of Gas Making and Main and Service Laying.

Applications, in own hand-writing, stating Age, Experience, present and previous occupation, and accompanied by *copies* of not more than Three recent Testimonials, to be addressed to the Chairman of the Gas and Water Committee, endorsed "Assistant-Manager," and delivered at the Town Clerk's Office, not later than Twelve o'clock noon on Wednesday, the 17th of July, 1907.

Canvassing members of the Council will be a disqualification.

By order,
C. F. Preston,
Town Clerk.

Town Hall, Barrow-in-Furness.

CITY OF LEEDS.
(Water-Works Department.)

APPOINTMENT OF CHIEF ASSISTANT-ENGINEER.

THE Water-Works Committee invite Applications for the Appointment of CHIEF ASSISTANT-ENGINEER in the Water-Works Department.

The Salary will commence at £200 per Annum.

Applicants must be duly qualified Engineers, not more than 35 Years of Age, and must have had Experience in the working of large Towns, together with waste prevention and Distribution.

Applications, Stating Age, Qualifications, and Experience, accompanied by *copies* of not less than Three Testimonials (which will not be returned), and endorsed "Assistant-Engineer," are to be sent to the Town Clerk, and must be delivered not later than Friday the 19th of July, at Ten a.m.

Canvassing directly or indirectly will be considered a Disqualification.

Charles G. Henzell,
Water-Works Engineer.

Municipal Buildings, Leeds.
July 3, 1907.

WANTED, Good, Sound, Second-Hand SCRUBBERS and WASHERS, Cast-Iron preferred, both capable of dealing with 50,000 to 100,000 feet daily.
Address "Gas-Works," care of J. W. Vickers and Co., 5, Nicholas Lane, E.C.

FOR SALE, Three Purifiers—Two of them 10 ft. by 6 ft. by 3 ft. 6 in. and One 9 ft. by 9 ft. by 3 ft. 6 in., with all Connections, in good working order.
Apply to Robert Muir, Manager, Gas-Works, Galston.

EXCEPTIONAL Bargain. 50 feet Double-Lift GASHOLDER, 60,000 feet capacity. Must be cleared by June. Splendid Bargain. Equal to new. Sacrificed and Re-erected at Nominal Sum for Immediate Sale.
Apply to Firth Blakeley Company, Thornhill, Dewsbury.

FOR SALE—A Station Meter, in very good Condition. Was thoroughly Overhauled and Repaired by the Makers Five years ago. Capable of passing 4000 feet per hour. Six-inch Valves and Connections with Cradle complete.
Apply to the Manager, Gas-Works, Old Whittington, near Chesterfield.

THE Widnes Corporation Gas Depart ment have FOR SALE the following:—
40,000 cubic feet per hour Combined STEAM-ENGINE and EXHAUSTER (Donkin).
200 2-Light Wet Ordinary METERS, in Cast-Iron Cases.
300 2-Light Wet Slot METERS, in cast-Iron Cases (by Braddock, Orme, and Alder and Mackay).
The Plant and Meters, which are in excellent condition, may be inspected, and any further Particulars obtained, on application to the Manager, Gas-Works, Widnes.

THE Hastings and St. Leonards Gas Company have FOR SALE, consequent upon the removal of the Carbonizing Plant to the new Glyne Gap Works, near Bexhill, the following:
30,000 cubic feet per hour STATION METER.
50,000 cubic feet per hour ENGINE AND EXHAUSTER.
30 feet square and 20 feet square PURIFIERS, with Lifting Gear.
SCRUBBERS and WASHERS.
ENGINES and BOILERS.
HYDRAULIC MAINS, Patent MOUTHPIECES and ASCENSION PIPES, &c.
Retort-House ROOFS, and a variety of other GAS-WORKS PLANT.
Also about 3 acres of VALUABLE FREEHOLD BUILDING LAND in the centre of the Town of Hastings.
For Particulars and to view apply to Chas. E. Botley, M.Inst.C.E., Engineer and General Manager, Gas Company's Offices, Queen's Road, Hastings.

FOR SALE—A Combined Horizontal STEAM-ENGINE and EXHAUSTER, with Inlet and Outlet Wheel Valves, Foundation Stones, Lubricators, &c. Maker, Bryan Donkin. Capacity, 10,000 cubic feet per hour. Excellent Condition. Removing to make room for larger Exhauster.
Apply to the Riddings District Gas Company, Pye Bridge, near Alfreton.

TENDERS FOR COAL.

THE Directors of the Malton Gas Com- pany invite TENDERS for the Supply of 4000 to 5000 Tons of GAS COAL or NUTS, to be delivered at the Coal Depôts of the North-Eastern Railway, Malton, in the Year ending the 30th of June, 1908.

Forms of Tender and further Particulars may be obtained on Application.

Tenders to be sent to the undersigned on or before the 20th of July inst.

Henry Tobey,
Secretary.

LEEDS CORPORATION GAS-WORKS.

THE Gas Committee are prepared to receive TENDERS for the Supply of 2000 Tons of GAS OIL for the Manufacture of Carburetted Water Gas, for a period of One Year, commencing on the 1st of September next.

Specification and Conditions of Tender may be obtained on Application to the undersigned.

Tenders, addressed to the Town Clerk, and endorsed "Gas Oil," must be delivered at the Town Hall, Leeds, on or before Saturday, the 20th inst.

The Committee do not bind themselves to accept the lowest or any Tender.

R. H. Townsley,
General Manager.

Gas Offices, East Parade,
Leeds, July 6, 1907.

HAYLING ISLAND GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company are prepared to receive TENDERS for the Supply and Delivery to the South Hayling Railway Station of 400 Tons (more or less) of Best GAS COALS, as required, during a period of Twelve Months commencing from July 21, 1907. Parties tendering to state name of Pits from where Coal is raised and also yield per ton.

Tenders to the undersigned not later than the first post on Tuesday, July 16, 1907.

The Directors do not bind themselves to accept the lowest or any Tender.

Geo. F. Preston,
Secretary.

7, Hampshire Terrace,
Portsmouth.

REINFORCED CONCRETE FLOORS.

THE Gas Committee of the Coventry Corporation invite TENDERS for the Supply and Construction, at their Foleshill Works, of REINFORCED CONCRETE FLOORS for Retort-House, &c., having approximate floor area of 2450 super. yards.

Form of Tender, with Specification, General Conditions, and Prints of Drawings, will be supplied on application to the undersigned, and on payment of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender.

The Committee do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Tender for Reinforced Concrete Floors," to be addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, and delivered on or before Nine a.m. on Wednesday, the 10th day of July, 1907.

Fletcher W. Stevenson,
Engineer and General Manager.

Gas-Works, Coventry,
June 24, 1907.

TENDERS FOR TAR.

THE Gas Committee of the Coventry Corporation invite TENDERS for the Purchase of the Surplus COAL TAR and OIL RESIDUUM produced at their Gas-Works during the Twelve Months commencing Aug. 1 next.

The quantity of Coal Tar will be about 4000 Tons, and will be loaded into the Contractor's Tank-Waggons at the Railway Wharf, Coundon Road, or Canal Tank Barges, Coventry Wharf.

The quantity of Oil Residuum will be about 170 Tons, and will be loaded into the Contractor's Tank-Waggons at the Gas-Works Sidings, Foleshill.

Forms of Tender and Contract to be entered into will be Supplied on Application to the undersigned.

The Committee do not bind themselves to accept the highest or any Tender.

Sealed Tenders, endorsed "Tender for Tar," to be addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, and delivered on or before Nine a.m. on Wednesday, the 10th day of July, 1907.

Fletcher W. Stevenson,
Engineer and General Manager.

Gas-Works, Coventry,
June 24, 1907.

IN THE HIGH COURT OF JUSTICE.
Companies (Winding Up.) No. 00416 of 1906.

IN THE MATTER OF THE KENT COUNTY GAS-LIGHT AND COKE COMPANY, LIMITED.
(In Liquidation.)

THE Freehold Gas-Works of the above- named Company, situated at Goudhurst, in the County of Kent, including Buildings, Plant, Purifiers, Mains, Services, Meters, &c., the Goodwill of the Business, and the benefit of all Contracts, are to be SOLD by the Liquidator.

Intending purchasers may obtain Particulars of past trading and permission to view the premises on making Application to the Official Receiver in Companies' Liquidation, Board of Trade, 33, Carey Street, Lincoln's Inn, London, W.C., to whom Offers to Purchase the property should be submitted.

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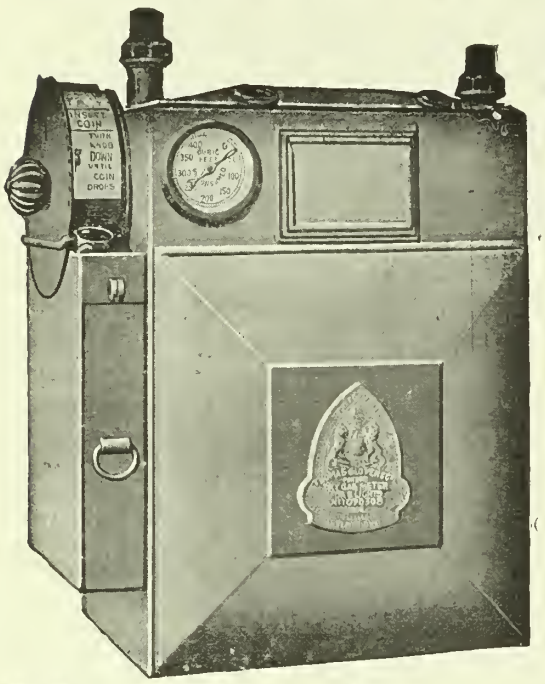

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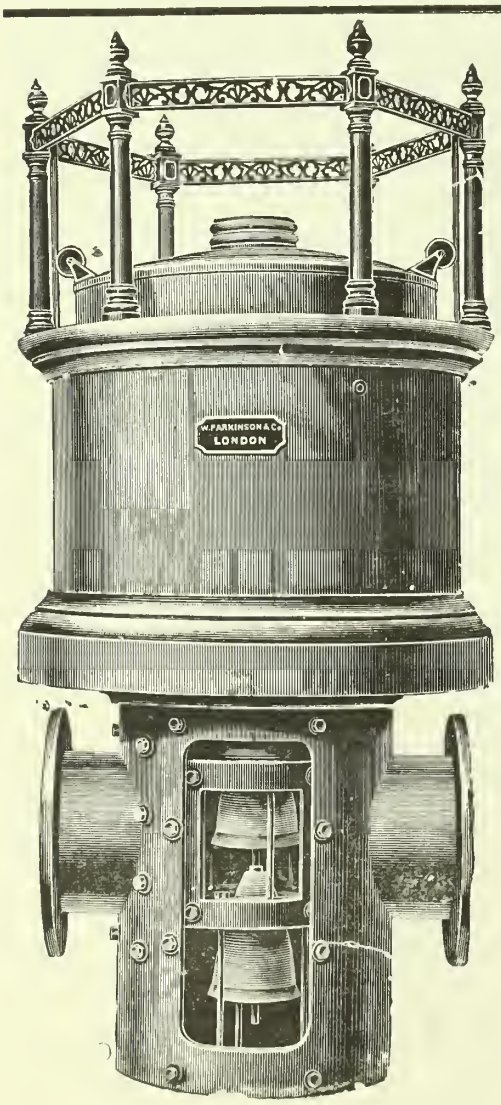

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. XCIX., No. 2305.——TUESDAY, JULY 16, 1907.

EDITORIAL NOTES—GAS, &c.

Higher Technical Education in the Gas Industry.

THE necessity for a higher standard of technical education in the gas industry has been impressed upon us more than ever of late. Latter-day experience has deepened the conviction that practical training, with gleanings of scientific knowledge by the way, will not be the best equipment for those upon whom will in future fall the duty of prosecuting the practical work of the industry upon the most scientific lines, and of pressing forward into those yet unexplored regions in which are to be made the roads to further progress. Science and practice must in future in this industry of ours be closer companions; and the knowledge of the most efficient individual will combine both. Generally but not comprehensively speaking, the practical man of the gas industry has not been a scientist, and the scientist of the gas industry has not been a man practised in the art of gas manufacture, distribution, and utilization. There has been an over-lapping of parts; but it is easier to see to-day than it has been hitherto that, where science can be brought to bear upon practice and practice upon science by the single individual, in that individual there is the ideal man to direct the technical work of manufacture, of distribution, and of the utilization of the primary and bye products. We cannot raise a spark of sympathy for the lamentations of those who aver that knowledge acquired by them in the higher realms of learning appertaining to their special avocation in the industry, has not availed them under past conditions in acquiring more lucrative positions. Their petulance born of disappointment cannot be taken as any trustworthy guide in the present, with its existing and exacting conditions and its omens. But with this recognition of what is necessary, there has not hitherto been devised anything that could be accepted as of ideal form for the specific training of men designed to take the helm in the technical direction of our gas undertakings. We have to conform the training to the needs; and the needs of the times are such that all should awake to the importance of proper provision being made.

This is a matter that has lain very near the hearts of the authorities at the Leeds University, more especially of Professor Arthur Smithells, who has throughout his professional career preserved very close association with the scientific investigation of problems of great moment in the utilization of the prime commodity of the gas industry. Their aspirations have been encouraged in high quarters. What, in consequence, has been done is now history. In connection with the University, there has been founded a Fuel and Metallurgical Department with Professor W. A. Bone at the head. The scheme has developed, and now comprised in it are special courses of training for those who have chosen, and will hereafter choose, the technical work of the gas industry as their profession. We have received from Professor Bone advanced proofs of the prospectus that has been drawn up in view of the completion of the buildings which have been erected, which will be fully equipped for this higher educational effort, and which will be open to receive students by Oct. 1. It is a pleasure to publish *in extenso* in other columns the sections of the prospectus referring to gas engineering, because we are decidedly of opinion that here there is delineated the comprehensive system of training on higher technical lines that will be of eminent value in future work directed to the advancement of the common prosperity of the gas industry. There are many points of detail in, apart from the general lines of, the scheme which are both noteworthy and commendable. It has been a common complaint attaching to technical training, that professorial notions as to what is fit and proper have over-ridden practical considerations. But the professors of Leeds University are of a practical grain, and court guidance direct from industrial knowledge as to requirements; and thus, while the work of the departments will be carried on under the immediate direction of the Professors of Mining and of Applied Chemistry (Professors Thompson and Bone), it will be in conjunction with an Advisory Committee composed of representatives of the various industries concerned. Students, it will be seen, are strongly recommended to take the degree, or B.Sc., course in Gas Engineering, which involves three years' attendance at the University. But this special training in the scientific principles underlying the industry is not intended to supersede the practical training in the works; and three years at the University, succeeded by three years' pupilage on a gas-works, is rather a long stretch for most young men before they can begin to look for even a junior engagement bringing them monetary compensation. Therefore we are disposed to think that the two-year course for non-graduates in the scheme will become the more popular for students of the scientific principles involved in the gas industry. Here, too, we may express gratification that the door to the advantages of the new departments has not been shut on those who are qualified as students, but who cannot afford to spend their whole time at Leeds. Intimation is made that a special course for outside students can be arranged with Professor Bone; and facilities can, also by arrangement, be made by qualified persons who desire to use the facilities of the department for special research work in connection with the industry's processes. There are here all the indications that Professor Bone and his associates desire to make the benefits of the department as broad as possible.

The plans include lecture courses; and for these outside specialists are co-operating whose names, we are in a position to say, being those of men of training and experience, will, when announced, command the confidence of the gas world. Full information is also published in the prospectus regarding the research fellowship for post-graduates, the establishment of which is due to the generosity of the Institution of Gas Engineers. The award of the fellowship will be made this year in August; and we are asked to give prominence to the fixture of the date by which applications must be received —viz., Aug. 10. Onwards from the middle of August, Professor Bone will be in Leeds, and will be pleased to answer all inquiries affecting the new work.

We must compliment those who have been prime-movers in this matter upon the completeness of their plans and arrangements; and this must be accompanied by an expression of heartiest thanks to those donors whose beneficence has enabled the work, at the very outset, to obtain such a solid foundation. The students are wanted now; and we are safe in promising them that they have here the right and proper provision—in men and conveniences—for acquiring, as preparatory or supplementary to their practical training, independence and self-reliance in that higher scientific work in the industry which irresistible changes of condition has brought, and will continue to bring, into existence. We hope that all who have part and lot in this work will reap a rich reward, and that the Leeds University will come to be looked upon as the Charlottenburg or the Harvard of the British gas industry.

Reinstatement of Meter-Rents in North London.

THE Directors of the Gaslight and Coke Company have resolved to re-establish the system of charging meter-rents, which, although the Company have never forfeited their legal right to them, have been discontinued since 1895. The circumstances under which the Board of twelve years ago made this concession to the consumers were somewhat peculiar. The Directors then vacillated over the question in a most singular manner—declining one month to yield to outside pressure in the matter, and declaring the course to be impossible, and almost the next yielding and proving the possibility by wiping the meter-rent charge completely off the consumers' accounts. The policy has never been without its disadvantages—partly through producing an inconsistency in London practice in this regard; partly through working un-

fairly in a district where large meters are continued in position as stand-bys, and for small casual consumption, where electric light is used; and partly through the contribution that the abolition of the meter-rents made to the difference between the charges for gas by the Gaslight Company and the other two Companies, who have never ceased to levy the charge. For after all, whether meter-rents are specifically charged or not, the interest on the capital, wear and tear, and so forth have to be met; and if the revenue for this purpose is not supplied as rent, then it must be furnished through an inclusive charge for gas. We can well understand that under the latter method, the charge bears unequally upon the consumers; seeing that, as the Governor (Mr. Corbet Woodall) was saying at the meeting of the proprietors in February last year, there are in the Company's area no less than 7000 meters, some of them of considerable size, through which no gas, or so little as to be negligible, passes during the year.

Mr. Woodall has been foremost in questioning the policy in this regard of the Board of some twelve years ago; and after what he said eighteen months since, the present announcement will not come as a surprise. The time is a peculiarly opportune one for re-introducing meter-rents, with the minimum of dissatisfaction, and without benefiting the proprietors at the expense of the consumers. On the contrary, the majority of the consumers will profit by the levelling of the incidence of the capital and other expenses attaching to the meters. The Company were bound to select one of two courses in view of the raising of the price of coal; and of the two they have, when their give-and-take attitude in the matter is considered, adopted what will henceforth, we think, prove to be the more politic of the two. An increase in the price of gas of only 1d. per 1000 cubic feet would have meant one-third more than the revenue they will derive annually from the restoration of meter-rents; and the Directors have pledged themselves not to increase the present price north of the Thames for at least a twelvemonth. But there is another concession that has to be made, in view of an understanding with the London County Council when in Parliament in 1903; and that concession will bind the Company in future to calculate their dividend as if the price of gas were 1d. per 1000 cubic feet higher than the actual charge. Virtually, this is equivalent to taking 1d. off the standard price. The Company's financial position, however, will be rather strengthened than weakened by the combination of alterations; and the additional revenue from meter-rents will go three-parts of the way towards maintaining the proprietors' position by keeping the price of gas 1d. lower than it would otherwise be. The prepayment meter consumers, too, will not be affected, as they would be if the price of gas were increased. Another point in favour of this revocation by the Board of the act of their predecessors is that it is a further step towards the unification of gas polity in the Metropolis. The matter is fully dealt with in a report by the Public Control Committee of the County Council; and they make out a very clear and favourable case which bespeaks ratification of the proposals by the Council to-day.

Relative Safety of Illuminating Agents.

Casualties—fatal and otherwise—arising from the use of various illuminants and heating agents, on being dissected, suggest that, notwithstanding all the channels through which intelligence and knowledge are conveyed, a great deal of ignorance still abounds, and that there is an immense field to be still exploited by the gas industry. Reflection on these matters succeeds the reading of the report by Herr Schäfer, of Dessau, on his compilation of statistics as to accidents caused by the production and use of illuminating agents in Germany during 1906. But this report must be read in conjunction with the previous more exhaustive one by the same gentleman (see "Journal" for Dec. 18 last), in order to ascertain the relative importance and significance of the figures. If we take the total figures, it will be seen that paraffin oil during the year maintained its record for producing the greatest number of fatalities—the death roll totalling 127. But this total is a considerable decrease on the previous year, when the figure was 202. We are indisposed to be quite so assured as Herr Schäfer as to the measure of influence in producing this tremendous decrease in fatalities of the competition of gas and electricity in lessening the consumption of oil. It is somewhat dangerous to draw such a deduction as this from the figures of any one year; as no one illuminating or heating agent is so exacting in its toll of victims that it must proceed or recede *pari passu* with increase or decrease in the quantitative use of the commodity. Herr Schäfer does not say that the difference is entirely due to the smaller consumption of oil through the greater use of gas and electricity, but that it is "primarily" due to that cause. We must, however, give to "primarily" the next place in importance to the term "entirely." While admitting and claiming that the increased use of gas and electricity must and does reduce the number of oil accidents, if we took the same sanguine view as Herr Schäfer, then we should have to admit that, with the continuance of the rate of the decline of the oil accidents last year, in two or three years the use of oil, as an illuminating and heating agent, would be wiped out altogether. However, succeeding years' figures do proclaim and guarantee coal gas as the safer illuminant; and therefore the inroads that it is making on the use of oil in domestic life must contribute to the safety of both person and property. Thus all that can be done in this direction, while furthering the interests of the gas industry, will also be of public benefit.

Like other public services, gas is not spotless of accident. But the number of casualties is small when regarded in relation to the volume of business done, and, as that business increases, naturally the scope for accident expands. Here we have an interesting comparison. The fatalities in Germany in 1906 in connection with gas numbered 41, and in connection with electricity 35. It will be remembered that Herr Schäfer, in his former investigation, showed the great disproportion of the application and use of gas and electricity, which—although the total figures for accident and death in the case of electricity were lower—indicated that electricity was, in view of the smaller volume of business done, the greater culprit of the two. But another instructive point in Herr Schäfer's present table is the enormous difference exhibited by the ratios of fatality to accident, between gas and electricity. While there were 41 fatalities from 112 accidents with gas, there were 35 fatalities from 42 accidents with electricity. The publication of the causes of death in connection with gas should act as a serious warning, and prevent the carelessness and disobedience that are responsible for the majority of the troubles and fatalities in which gas has part. It is a grave matter that it should be possible for Herr Schäfer to be able to trace 17 gas explosions, accompanied by six cases of poisoning (mostly fatal), through the ends of service-pipes being left uncapped after the removal of fittings, or through burner-taps being left on when the main cock is turned off, and consequently affording free passage to the gas on the latter being turned-on again. One further small criticism. We think that Herr Schäfer might have qualified his reference to instantaneous water-heaters. He says these "appliances "are still occasionally employed, in spite of all warnings." It would have been better if after "employed," he had inserted the mitigating and proper phrase "without suitable "ventilation." Germany, it is remarked, offers a good field for the exploitation of gas heating. The 73 cases of carbon monoxide poisoning from the combustion of fuel in the closed type of heating-stove should supply a good motive for activity and change. But these accidents and the numerous ones arising from the use of paraffin, only supplement illustration of the difficulty of divorcing people from the habits to which they are wedded.

Public Lighting and Increases in Gas Prices.

The electrical people are looking round to see whether there are any pickings to be made out of the increases of gas charges here and there caused by the advances in the price of coal; public lighting being particularly sought after, as the account is a substantial one—for them. A rise of 2d. or 3d. per 1000 cubic feet does not, for lighting purposes, make much difference to the ordinary householder; and therefore, as electricity suppliers cannot very well afford to offer the private lighting consumer anything, in these times of dearer fuel, by way of reduction, it is of very little use, with the great difference in value in favour of gas compared with electricity for indoor purposes, for the purveyor of the latter to endeavour to utilize the 1d., 2d., or 3d. increase in the price of gas as a lever for securing a change-over of custom. Precedent informs the householder that increases in the price of gas necessitated through the higher cost of coal are only of comparatively short duration, and that, in the case of sliding-scale gas companies, the price of gas slips back on the very earliest opportunity—self-interest and

competition being both impelling factors. This fact should be borne in mind by public lighting authorities, who may be a little more inclined, where there are advances in the public gas-lighting account by a few hundreds of pounds, to listen to the voice of the electrical tempter. But it will be remembered that the increases in gas prices that have been, or may be, made only cause a reversion to prices that commonly ruled as ordinary in quite recent times. When much higher prices obtained for gas, the total costs for public lighting were small compared with the total costs where electricity has been established on a comparatively limited scale. Take the latest published example of Shoreditch. In 1897, when the streets were lit entirely by gas, the cost of public lighting was £6244; last year, the cost was £13,295, and of this £9212 was spent on electricity. As an economical and efficient lighting agent, electricity has some distance to traverse before it overtakes incandescent gas lighting; but we have no doubt electricity suppliers, even in these days of increased fuel costs, would be glad enough to surrender something to get a still larger share of the public lighting—that is to say, a larger share in extent, as well as in respect of revenue, of which they have the larger share now in many places for the smaller service rendered.

Electricity suppliers are subject to the same increase of works' costs as gas makers through advanced coal prices—in fact, fuel (every unit of electricity generated absorbs in the best working 3½ to 4 lbs. of coal) is the heaviest part of the works' costs; so that electricity, like gas, cannot escape enhanced working expenditure on this account. We notice that, in some places the electricity power contracts (which are often cut so fine that it is a toss-up whether or not they will be beneficial to an undertaking) contain a clause providing for the adjustment of the contract price in the event of variations in the cost of coal. Public lighting authorities will bear these considerations in mind when electricians use the opportunity of an increase in the price of gas to reopen the question of public lighting. It must also be borne in mind that, when once electricity suppliers get hold of public lighting, the heavy expenses involved in conversion from incandescent gas lighting to electricity go some way to prevent the extinction of their tenure as light providers in the streets in which they become established. It is observed that the Finance Committee of the Hammersmith Borough Council, in view of the increase in the price of gas for public lighting from 2s. 2d. to 2s. 5d., have instructed the Electrical Engineer to report to the Electricity and Lighting Committee (the combination of the management of the Electricity Department and the control of the public lighting ought not to be allowed in the interests of good and independent administration) as to the advisability of lighting by electricity all the public lamps in the streets where cables are laid. No doubt the Electrical Engineer will, by the indulgence of the Electricity and Lighting Committee, make a seductive report on the matter. But it is to be hoped the report will be open to the criticism of the gas authorities before any action is taken upon it; so that the Council and the ratepayers may have the material before them on which to deal with the subject in a judicial spirit.

Gas-Works and Factory Inspection.

The annual report on the inspection of factories and workshops contains (as will be seen in other columns) matter of more than usual interest to gas engineers—considerable attention having been paid to the construction and lighting of purifier-houses, to the use of flueless gas-stoves in factories, and to suction and producer gas plants. With reference to the construction and lighting of purifier-houses, the manner in which the inspectors deal with the question indicates a somewhat superficial acquaintance with the subject; and we may, with all respect, assure the inspectors that gas engineers are fully aware, by painful experiences, of what is needful in rendering such buildings safe. The object of official inspection is to keep those in authority up to their duty. But there is little they can be taught as to what that duty consists of. We hope there are no gas managers so insensible to their responsibility that they neglect any precaution for safety that it is within their power to make; and, on the whole, the report shows this to be the case, though, we are sorry to say, not completely. For use in purifier and other houses in which fortuitous accumulations of gas may occur, it is interesting to see that electrical hand safety lamps are growing in favour; but those engineers who are adopting electricity for places where explosive mixtures may be formed will, after the Dublin disaster, eschew lamps suspended by flexible wiring, and have nothing but fixed lamps with both wires and lamps well protected. Bad examples of unventilated purifier-houses appear to be few; but still it is evident there is yet, in cases, work to be done in making adequate provision to prevent the lodgment of gas in purifier-houses. The open-shed principle commends itself to the inspectors, as it does to most advanced engineers. But mistake is made by the inspectors who suppose that in such purifier-sheds the need for artificial light does not arise—particularly where the purifiers are elevated to facilitate their discharge and to give access to the connections. Work and attention at night time are occasionally imperative, and some form of light is then required. Concerning the use of flueless gas-stoves in factories, these seem to be especially repugnant to the inspectors; but we would suggest to them that if, instead of discouraging their use in large factories, they would do their utmost to bring about the rational ventilation of all work-rooms, their opportunities would be more usefully employed. From the report may be gathered evidence as to the dangers to workpeople introduced into factories by suction and producer gas plants.

Reissue of the "South Luton" Prospectus.

The gas company promoting tricksters are angling again after the money of the public. It is still in connection with the latest of their adventures—the diminutive Markyate Gas-Works, floated under the grandiose style of the "South Luton District Gaslight and Coke Company, Limited." In January last, the first prospectus was issued; and comment was then made upon it in our pages under the heading "Another Insolent Prospectus." At that time, the promoters did not get the £30,000 of hard cash they required. Then evidence was forthcoming which gave us every reason to believe that attempts were being made to palm off the rubbishy shares on the public (in lots of 25 £5 shares), through the aid of "For Sale" advertisements in provincial papers. To this we duly gave attention in the "JOURNAL" as recently as June 11 last. If our surmise was true on that occasion, that ruse also failed. And now these promoters are trying the effect of a reissue of their prospectus, supplemented in a few respects, in getting rid of the unissued balance of the capital—viz., no less a sum than £21,740. They dearly want the money; but the money is not necessary in the interests of the Markyate Gas-Works nor of those ignorant and foolish people who have taken up any part of the allotted 714 preference and 957 ordinary shares—representing £8260. This is quite easily proved. The vendors were the Gas-Works Extension Construction Corporation, Limited (a concern which has already succeeded in making for itself a reputation in connection with these flotations); and they were selling this ineligible property, and undertaking to erect a "gasometer" (forgive them their technical knowledge, and that of their Consulting Engineer, Mr. Frederick Pontifex, who speaks of gas-works plant as "utensils," which, however, is perhaps a fitting expression for the character of the plant required at Markyate), retorts, with requisite buildings, &c., for the sum of £23,350. The agreement says that 20 per cent. of this is to be paid in cash, and the balance in cash or by the allotment of fully-paid preference or ordinary shares "at the vendors' option." Obviously, the vendors' option is "cash," rather than be saddled with preference or ordinary shares in the Markyate Gas-Works (the value of which they know better than anyone); inasmuch as the £8260 said to have been already subscribed would be ample to pay them 20 per cent. of the contract money, and give the Company nearly £3600 working capital, which would be more than abundant. The remainder of their extortionate price, the vendors could have in shares. The existing shareholders, however, must be careful of their position, lest the vendors force their option, and rob the shareholders of the little value they have in the insignificant property represented by their present capital.

An Appeal to Lady Shareholders.

The present prospectus is full of the same craftiness to which we have called attention in commenting upon similar specious productions. There is a pretentious display of prospects and anticipations, but no real particulars as to business done, actual promises, or anything definite as to capacity of plant. There is the same old "castle in the air" in the shape of an imaginative estimate, with a contemplated sale of 25 million

cubic feet at 5s. 10d. (!) per 1000 cubic feet, giving (with other revenue) a 6 per cent. dividend on the preference shares and 15 per cent. on the ordinary, and still leaving £683 to be carried forward. Somebody is "telling fairy tales;" and these "fairy tales" are, on this occasion, being circulated among lady shareholders in other gas companies. Inquiries among several gas shareholders of the masculine gender reveal that they have not been favoured with copies of this re-issued prospectus; but ladies have been invited to sink their money in this (for them) visionary gold mine. The Gas-Works Extension Corporation, Limited, are living in hope that what the ladies sacrifice they will handle, and keep in the safe custody of their own banking accounts. Apologies are due to the ladies that men should seek to make them their dupes. The whole business is a sickening one.

Lists of Shareholders Wanted.

While on this distasteful subject of the promotion of hopelessly over-capitalized gas companies, it may not be amiss to draw attention once more to the efforts that are being made, in quarters which leave little room for doubt as to the purposes for which the information is required, to obtain lists of shareholders in old-established undertakings throughout the country. In the first place, application was made direct to the Secretary of the Company the names and addresses of the proprietors in which it was desired to obtain; but the success of this move was evidently not so complete as the applicants could have desired—in spite of the plausible character of the excuse that was put forward for proffering the request. Recourse has therefore been had to other methods, which it is to be hoped will in their turn prove equally unsuccessful. In fact, it is precisely with the idea of placing the officials of gas companies upon their guard in respect to the matter that reference is made to it. To put it briefly, the latest dodge is to address a communication to a solicitor practising in the town whose gas proprietors are a special object of solicitude on the part of the writers. The epistle which is now before us is an excellent exposition of the art of "polite letter writing," and opens with the statement that a list of shareholders in a particular gas company is desired—the remark being (regretfully, one can imagine) added that only shareholders are entitled to apply for such lists. Then the real object of the letter is entered upon, in the following terms: "Perhaps you are a shareholder yourself, or know some of your clients who are, through whom you could obtain the list for us. All we require is their names and addresses . . . . The list is for our private use only, and not for publication." By refusing to have anything to do with such a request, should it reach them, solicitors and shareholders in gas companies might be the means of preventing the hopeless loss of good money by people who may unfortunately not themselves possess that knowledge which would enable them to make a proper discrimination in the investment of their capital.

Statutory Companies and their Responsibilities.

The litigation proceedings between the Caerphilly District Council and the Rhymney and Aber Valleys Gas and Water Company, reported in the last and present issues of the "JOURNAL," direct attention once more to the question of the duties and responsibilities of statutory companies entrusted with public services such as the supply of gas and water. These bodies are invested by Parliament with large powers, which they have to exercise on certain conditions; and provided these are complied with, no attack—from whatever motive prompted—can be successfully sustained. Proof of this was afforded by the recent action of the House of Lords in the Hull case, in which it was recognized that the Gas Company were properly discharging their duty as suppliers of their special commodity. In the Rhymney Company's case it was otherwise. In consequence of several unfavourable reports by the Medical Officer of Health as to the quality of the water, the Caerphilly District Council deemed it to be their duty to set the Attorney-General in motion in order to obtain an injunction to restrain the Company from supplying water impure and unwholesome in character, and consequently dangerous to health. The matter came before Mr. Justice Swinfen Eady, who had to hear somewhat conflicting evidence. Dr. Thomas, the Medical Officer of Health, and Dr. Smith, the Principal of the Royal Institute of Public Health, roundly condemned the water; the latter saying it could not, by any stretch of the imagination, be called "pure and wholesome." Sir William Crookes, however, whose quarter-of-a-century's experience as a Metropolitan Water Examiner should have enabled him to speak with authority on the subject, said the water, according to his samples, was "perfectly pure and wholesome." The engineering evidence given by Mr. Watson, of Bradford, for the plaintiffs, was not calculated to bear out such a statement; but Mr. E. K. Burstal, for the defendants, showed that they were making a move in the direction of improving their works by removing farm buildings from the vicinity of reservoirs and the construction of filter-beds. They called their present Engineer; but as he had only occupied his position since the 1st of April—four months after the issue of the writ—and, of course, could only speak as to what he had been doing since that date, his Lordship thought his evidence was immaterial. The proceedings related to a condition of things in existence long before he came on the spot, and for which, consequently, he was in no way responsible. In the result, his Lordship, while accepting what had been said as to the defendants' intentions as evidence that they were bestirring themselves to improve the quality of their water, said he had no difficulty in coming to the conclusion that they had in the past failed to discharge their statutory obligation to furnish a pure and wholesome supply; and he ordered them to pay the costs of the action up to and including the hearing. On this point, therefore, the plaintiffs were successful; but they failed to substantiate their complaint that the defendants had "refused" to do anything to improve their supply. His Lordship declined to grant an injunction, as its effect might, he said, be to deprive the inhabitants of water altogether; but he gave the plaintiffs leave to apply again in six months, if so advised. In view of the work the Company have now in hand, we think, with his Lordship, that no further application will be necessary. The pity is that it ever had to be made. We recognize that the Company may have been hampered to a certain extent by the death of their Surveyor and the retirement of their General Manager; and also that their position in a scattered district, with half-a-dozen District Councils and two County Councils to deal with, is a difficult one. But it is in such circumstances as these that there is all the greater necessity for the exercise of tact, and the adoption of a conciliatory attitude; and probably if more of this spirit had been displayed on both sides before the issue of the writ, the money which has been spent in litigation would have been available for carrying out works which the Company themselves acknowledge are necessary.

Following on their Heels.

It will be remembered that at the annual meeting of the National Electrical Manufacturers' Association, there was a discussion on the question of holding an electrical exhibition in Manchester; and the opinion of a majority—maybe a very narrow one—was that they, as manufacturers, would rather not have another exhibition for a year or two. Things are not quite so prosperous with the electrical manufacturers as they wish; and there does not seem to have been much, if any, improvement in their profits as a result of the exhibition at Olympia. Therefore, the manufacturers may well muse over the question, How does it profit us if we show the whole world what we can do, if additional prosperity does not succeed? Clear it is that Olympia has not helped them. An article in the last issue of the "Electrical Review" was directed to stirring up the manufacturers to look at the question of an exhibition in Manchester "in the broadest possible manner from the standpoint of the electrical industry." In the article, we find this (coming from an electrical contemporary) very flattering admission: "May we remind that one of the most powerful influences which led to the organization of the Olympia Show of 1905 was the success of the Gas Exhibition that preceded it." Then follows the inquiry: "Are we to wait until the gas interests make another big effort, and then to follow on their heels?" The answer is that the organizing of an exhibition in Manchester now would be a following on the heels of the gas industry, as one demonstrating up-to-date methods of utilizing gas for lighting, heating, and industrial purposes will be in full swing in Manchester in the coming autumn. At the present time, there is also a Gas Section at the Irish Exhibition. There is argument here for further inciting the interest of electrical manufacturers, if the negative profit results of Olympia can but be banished from their minds.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 189.)

Again the Stock Exchange has had a week of accentuated variety—changes coming in quick succession and without giving much notice. Meanwhile, it being account week, the settlement was going on, and was perhaps not altogether free from anxiety. The opening seemed rather dull; but it soon brightened up, and things took a favourable turn—Consols setting a good example. But on Tuesday the wind was blowing from the opposite quarter. Sellers were more conspicuous than buyers; and the move to secure profits had a chilling effect. Wednesday was rather worse. The bad weather had a depressing influence, especially inimical to railway traffic, the American market was uneasy, and things generally were flat. The gilt-edged lot not only lost what they had gained, but a bit more. Next day, however, there were signs of a recovery; and, though Consols were a little lower, the position all round was not uniformly as bad. After a little hesitation, the improvement fortified itself on Friday. Buyers once more showed their welcome presence, and the weather took a very agreeable change; and so prices picked up a little. This happier state of things continued the next day; and the close of the week was about the best of it. In the Money Market, there was the usual demand for the Stock Exchange requirements, but the supply was always fully equal to the call. Discount rates were at first firm; but the tendency was towards greater ease before the week was out. Business in the Gas Market aggregated about the same bulk as the week before. It was not evenly spread, however, and on Saturday there were only six transitions marked altogether. Another feature was the unusual prominence of some issues which do not generally emerge into conspicuity. The general position was firm and steady. Hardly any quotations moved at all; but the few that did moved upward. In Gaslight and Coke issues, the ordinary was quite active at first, but quieter later on. The opening deal was at 95½, from which figure the price steadily advanced until 97 was touched on Thursday—the quotation being 1 up. The secured issues had quite a lively time, especially the preference, which was in great demand and rose 2. Dealings in it ranged from 104 to 106, in the maximum at 89 and 89½, and in the debenture at from 83⅛ to 83¾. South Metropolitan was more active and showed a disposition to advance, though the quotation was left standing. Prices marked ran from 119½ to 121. The debenture changed hands at 83¼ and 83½ *cum div.* and 82 *ex div.* Commercials were again quite unnoticed. In the Suburban and Provincial group, Alliance old was done at 20¼ and 20¾, Bournemouth preference at 15⅞ and 15¾, British at 41 and 41¾, Bromley "B" at 91 and 91½, Hastings 5 per cent. at 116½ and 117, South Suburban at 120½, Tottenham "B" at 100½, and West Ham at 103½. Among the Continental Gas Companies, Imperial was moderately active at from 171½ to 173. European fully-paid marked 23½ and 24. Union was not dealt in. Tuscan marked $10\frac{11}{16}$, ditto debenture 101½, and Malta 4½. Among the undertakings of the remoter world, Bombay was done at 6⅝, Oriental at 142, Buenos Ayres at 11⅜, ditto debenture at 94½, Primitiva at from $6\frac{25}{32}$ to 7, ditto preference at $5\frac{1}{16}$ and $5\frac{3}{16}$, and River Plate at $13\frac{1}{16}$.

ELECTRIC LIGHTING MEMORANDA.

A Drop in Provisional Orders—Reduced Consumption and a Big Deficit at Brighton—Floundering About for Business at Hastings—The Escapade of a Motor Bus—Necessary Advice—A Storm in a Teacup.

There are signs that local authorities are becoming nervous about taking up the provision of electricity for lighting and other purposes, where they have not already done so. The bad experience—bad excepting in specially favourable areas—of others must be having an effect; and the ratepayers of those towns that have been waiting and watching must now feel very grateful that caution has prevailed. The Board of Trade have issued their report upon the applications received by them in December last for Electric Lighting Provisional Orders, to be dealt with in the present session of Parliament; and we find that there has been a considerable shrinkage in the number of applications. The gradual dropping away of numbers has been going on since 1900; but this year the diminution is somewhat marked. There were only 33 applications altogether; 16 being by local authorities, and 17 by companies or persons. Only 23 of the Orders have been granted by the Board; and a decision upon one is still in the balance. Four Orders were refused by the Board; and in the case of five, the promoters decided not to proceed. The number of Orders applied for in the previous three years was respectively 74, 62, 55, of which the Board granted 65, 56, 49—the confirmations by Parliament embracing 57, 56, and 48. Therefore the number granted by the Board in the present session will not, when the Order in suspension is settled, exceed half the number of Orders confirmed by Parliament in 1906. The total number of Electric Lighting Orders confirmed by Parliament since 1883 not including this session) is 1013, of which 227 have been revoked or repealed. Since the previous report, the Board have approved 22 deeds of transfer of powers, duties, and liabilities—mostly from local authorities to power companies.

The Brighton Corporation are sorely vexed. Some time ago they had the President of the Local Government Board to inaugurate the new Southwick generating-station; but the Southwick station has not yet come up to expectation, nor has the presidential blessing yet had any effect. There have been, we are told, delays in getting the plant completed and put into regular operation, and the more uneconomical North Road works have had to be maintained under steam. It would be interesting to know the nature of the delays at Southwick. The Electrical Engineer does not appear to be quite convinced in his mind that the Southwick station is going to relieve him entirely of reliance on the old works; and the Chairman of the Electricity Committee does not seem to be altogether clear as to whether the Southwick policy is going to be a complete success. Again, the Engineer reports that business "seems" to be slightly improving. We recognize the beautiful convenience of the term "seems," because it is found, in another part of the report, that the sale of electricity in the year ending March 31 last was 7,849,194 units, or a decrease on the preceding year of 151,006 units, of which 75,350 units were due to the reduced consumption of the Tramways Department; and the remaining 77,656 units to the decline in consumption on the part of private consumers. As to the financial result, the deficiency on the year was £10,233. There may be consolation, under such circumstances, in thinking the business "seems" to be improving. The loss of private consumption is said to be "greatly due" to the extensive use of the new high efficiency lamps; so that it may be imagined that the bed-rock of loss in this direction has not yet been touched. The report ignores any custom having retraced its steps to the Gas Company, although this has contributed to the loss of private consumption; and the secession is not yet extinguished. The electricity revenue from all sources during the year decreased by £4661; while interest and sinking fund charges advanced by £5215. The deficiency of between £10,000 and £11,000 is going to be made up by realizing part of the securities in which the small reserve fund is invested. This will enable the Committee to tide over the present all right, but what of the future, with its more expensive fuel and greater demands for interest and sinking fund, and with a reducing consumption? The Engineer has predicted a large economy in works costs from the Southwick station; but we are curious to know whether in his computations he has taken into account the increased cost of fuel.

Remark was made last week upon the atomical increases of "net profit" that the Hastings Corporation Electricity Department are enjoying, through the kind aid of the assessment authorities and the public lighting. An inquisitive councillor has been looking into the matter; and the result is he also finds that progress—we cannot say prosperity—comes with snail-like pace to this undertaking. At the end of June last year, the number of consumers on the books was 797; at the end of last month, there were only 35 more—an average increase of rather less than three per month. But the capital expenditure incurred during the twelve months on new mains and house services has been out of all proportion with this increase; the sum spent having been £1631. The Local Government Board have sanctioned a further £4000 for spending in this department; and already £1501 has been allocated to new mains and services, and £1508 is going to be spent in extending the cables to the Clive Vale district. This is an interesting extension, which ranks with many another unbusinesslike action of the Corporation Electricity Committee. Before making this expenditure, the district has been canvassed, presumably to test the wisdom or otherwise of making such an outlay. Judge of the decision of the Electricity Committee by the figures! The number of householders favoured with the attentions of the department was 812. Just 40 more than one-half that number, or 446, took the trouble to reply, and only 32 occupiers intimated that they would "probably" use electricity, 8 being doubtful. We should regard the 32 "probables" also as "doubtfuls." But charitably granting that there are 40 likely consumers, this leaves 406 of those who troubled to reply (not counting the 366 who did not answer) who were evidently definitely in the negative. We should like to see these 406 replies. It is not surprising to find the Committee have decided not to cover Clive Vale with cables; the point for surprise is that they are going there at all—and at a cost of £1508. In the roads in which they are laying cables there are eighteen houses from which "promises" have been secured. The estimated custom of these eighteen houses is put at an average of £10 a year, or £180 in all. After paying the interest and sinking fund on the capital expenditure, the Committee will be left with a problematical profit of £11. We wonder whether staff and office charges, collection, maintenance, depreciation, and rates and taxes have all been faithfully taken into account before arriving at this £11. As a business proposition, we should not like so narrow a margin of estimated return on a capital commitment of £1508. By eighteen councillors out of a voting twenty-eight, the movement to Clive Vale is regarded as a progressive one on the part of the department; and we admit that a movement may be progressive to a disadvantageous end.

The motor 'buses of London continue to give exhibitions of feats of strength, choosing as their opponents the street lamps; and by this preference much annoyance is caused to local authorities, pedestrians, and residents in the neighbourhood of the impromptu exhibitions. The extent of the injury inflicted by the generally victorious motor 'bus varies according to the choice of the object of contest. If it is a gas column, the putting of the lamp out of action only affects it individually, while a successful

bout with an electric arc lamp may plunge the whole of a district on the particular circuit into darkness. Under such circumstances, the victory for the motor 'bus in the greater. Such an event occnrred in Regent Street last Tuesday evening. A motor 'bus butted one of the electric light columns, on a refuge in the centre of the road. The column could not withstand the impact; and over it went. An incidental, but much more serious, effect was that the whole of Regent Street where electric lighting was in nse was plunged in darkness. That motor 'bus was doubtless proud of its achievement. Visitors returning home, at a late honr, *viâ* Regent Street, from the Society of Arts *conversazione* at the Botanical Gardens saw the pieces of the disgraced column and lamp being collected and removed. Reference was made some time ago to the danger of putting the central electric light columns in Oxford Street; and this incident accentuates what was then said.

A short time since, there was occasion to comment in these columns upon the inconsiderate admiuistration of the Watford elcctricity nndertaking by the local authority; their rnle of action including the principle that it is quite permissible to sacrifice the ratepayers in order to endeavour to make electricity trading pay its way. In so directing their administration of the electricity nndertaking, the Council have brought themsclves into ridicule. They have shown a lamentable deficiency of commercial sense; and this was made public at the inquiry recently held by the Local Government Board, into an application for £13,500 for electric lightiug purposes. The outcome of the inquiry is that the amount has been redneed to £8151. The sanction was found to be accompanied by a rebnke for having entered into an agreement to supply a firm with electricity for power at as low a price as 1d. per uuit when it was proved that it conld not possibly be furnished at the price, and also by an entreaty to "carefully compare the cost and advantages of lighting by electricity and gas before proceeding with any further extensions of the system of lighting streets by electric incandescent lamps." The Board have likewise suggested to the Bexley Urban District Council that it would be well, before undertaking any further extension of the public lighting by electricity, for them to "carefully consider the comparative cost of lighting streets by gas and electricity." One of our electrical contemporaries thinks the advice is gettiug a little threadbare from constant repetition. If our contemporary would pay heed to the rapid growth of expenditnre on public lighting, which large growth is restricted to small districts, there should be no difficulty in seeing the nced for the repetition of the Board's sound advice.

There has been what may be likened to a storm in a teacup at Sheffield. We know that the Electricity Department of the Corporation have a stiff time of it, in beating up business against the cheap supply of gas furnished by a progressive Company; and it seems that the continued indifferent success as a profit-makiug concern of the electricity undertaking has caused people to look a little more narrowly than formerly into their accounts, with the result that there has been some spreading of a feeling of insecurity that the financial status of the department is not exactly as represented. Not that anything dishonourable has been suspected, but that the financial affairs of the department are not presented with that freedom from ambiguity that could be desired. That this feeling should have got abroad is clearly the fault of the department in not giving ample explanation on certain matters. It cannot be expected, nor would the staff of the Electricity Department welcome this sort of thing, that people who tronble to look into the published accounts of the undertaking, should be compelled—to obtain elucidation of doubtful points—to call at the offices of the department, or communicate with the officials by telephone. There is, for example, the question of salaries. The amount paid was known; the amonnt charged in the department's accounts were considerably short of the snm. Now it appears that the salaries are apportioned between the undertaking and the trading department; and the detailed accounts of the trading department are not published. Bnt the apportionment seems hardly fair, seeing that, for instance, only half the Engineer's salary is debited to the electricity nndertaking, and the other half to the trading department. If an explanatory line had been pnt into the accounts, it would have obviated trouble on this score. However, there has been some criticism on this and other points—snch as the question of depreciation and a proper reserve fund. The City Accountant has also taken upon himself to comment npon the policy of the Council in respect of certain matters. Throngh these nnpleasant occnrrences, and because the Lord Mayor (Alderman Styring), who is Chairman of the Electricity Committee, thought the criticism was dictated by political bias, he resigned his chairmanship; bnt at the meeting of the Council last Wednesday, there was such overwhelming testimony of the criticism having no personal intention, of respect for his lordship, and of desire that he shonld not take the step npon which he had determined, that it is likely he will give the matter favourable reconsideration. Yet another question that was discussed at the meeting was as to whether or not Mr. Fedden, the Engineer, should be granted an increase of £100 a year in his salary. We deliberately say the rejection of the proposition was not in the best interests of the department. An undertaking fighting against snch heavy odds as that at Sheffield requires the fittest man; and to-day the fittest man for the Sheffield electricity undertaking is Mr. Fedden. His is a difficult task; and we have ever been opposed to that parsimony in mnnicipal affairs that refuses good pay for good service.

GAS ENGINEERING AT THE LEEDS UNIVERSITY.

The Proposed Courses.

It may be remembered that in the "Journal" for the 2nd inst. it was mentioned, in a paragraph on the subject of the courses in "Gas Engineering" at the Leeds University, that Professor Bone, who is at the head of the Fuel and Metallurgy Department of the University, was then engaged in preparing his prospectus. He has now forwarded an advance proof, the following extracts from which will inform intending students as to his plans.

Before giving particnlars in regard to the courses of study with which our readers are specially concerned, it may be of interest to mention that the new buildings which have been erected at the University for the accommodation of the Fuel, Gas Engineering, and Mining Departments will be ready and equipped for the reception of students on the 1st of October. The cost of the building and its equipment has been largely met out of a fund of £8000, raised by the Yorkshire coalowners, through the efforts of the late Alderman A. Currer Briggs, J.P., acting as Chairman of the Mining Committee of the University. The building, which has been erected to the plans of Mr. Panl Waterhouse, is a three-storey rectangular structure situated in close proximity to the main University buildings in College Road. The gronnd floor comprises (1) a general mining laboratory, connected with an outside coal-washing aud ore-dressing shed, (2) a photometric and lamp room, and (3) workshops and store-rooms. The first floor provides accommodation for the students of "Fuel aud Metallurgy"—viz., (1) general laboratory, (2) fnrnace-room, (3) microscopic and balance room, and (4) gas analysis room. The top floor comprises (1) a lecture-room, accommodating up to 50 students, (2) a drawing office with adjacent snn copying room, and (3) a large musenm.

With regard to the subject of "Gas Engineering," the firm of Messrs. George Bray and Co., Limited, have given a handsome donation towards the equipment of the fuel laboratories; while promises of support have been received from the Gas Committee of the Leeds Corporation, as well as from gas compauies. The Institution of Gas Engineers, as our readers are aware, have also decided to establish a fellowship for post-graduate research in the chemistry of gases and combnstion; while arrangements are under considcration whereby the Institution will be able to carry out a scheme of technical research work in connection with the University, under the direction of a Joint Research Committee, consisting of representatives both of the industry and the University staff. The work of the departments will be carried on under the immediate direction of the Professors of Mining and of Applied Chemistry (Fuel and Metallurgy)—viz., Professors Thompson and Bone—acting in conjunction with an Advisory Committee, composed of the representatives of the various industries concerned, with Mr. W. E. Garforth, M.Inst.C.E., as Chairman.

The degree courses are primarily intended for the systematic trainiug of students who can devote at least three years to the study of the scieutific principles underlying the practice of the various industries for which they are preparing themselves. They are not intended to supersede the nsnal apprenticeship in a mine or works, but rather as preparatory or supplementary courses to snch a practical training, which actual experience on a works can alone adeqnately supply. Special facilities will be provided for post-gradnate research work, both in the laboratories of the departments and in mines and works outside; and every help will be afforded to graduates who, on passing into the industry, find themselves confronted with problems which can be advantageonsly worked out in conjunction with a well-equipped scientific laboratory. Provision will also be made to meet the requirements of any occasional students who are qnalified to take advantage of the regnlar conrses of instruction; while graduates of other Universities will be admitted as research students.

In the Fuel and Gas Engineering Department, courses of study have been drawn up by Professor Bone to meet the reqnirements of students who are preparing for responsible positions either as gas engineers or in the fuel industry. The courses in "Gas Engineering" and "Technology of Fnel" will chiefly deal with the mannfacture and distribntion of coal gas and gas lighting problems, bye-product coking processes, and the production and application of gaseons fuels for heating and power purposes.

Students who can devote three years to attendance at the University are strongly recommended to take the B.Sc. degree conrse in "Gas Engineering." Before commencing this conrse, however, they must pass the matriculation examination, conducted by the Joint Matriculation Board of the Universities of Manchester, Liverpool, Leeds, and Sheffield, particulars in regard to which may be obtained from the Regulations for the Matriculation Examination contained in the University Calendar, and also from the calendar of the Joint Matriculation Board, which is obtainable from the Secretary, Owens College, Manchester, for 8d., post free.

During the first year of the degree conrse, the student will pursne a conrse of study in the fundamental sciences of Mathematics, Applied Mechanics, Physics, and Chemistry, for the intermediate examination, which is taken at the end of the first year. After passing this examination, the student will, during his second year, continne the study of Physics and Chemistry, and will also take a course in Engineering and Mechanical Drawing, as well as a special conrse of lectnres in the Chemistry of Gases, supple-

mented by laboratory work in Fuel. During the third year, he will mainly devote his attention to his special subject—*i.e.*, Gas Engineering—but will also spend six hours per week in the mechanical drawing office (Engineering Department). The three-years course will thus include systematic training in Mathematics, Physics, Chemistry, General Engineering, and Mechanical Drawing, in addition to the study of the special branch of applied Science—viz., Gas Engineering. At the end of the course, the student will qualify for the B.Sc. degree by passing the prescribed final examination in Gas Engineering as principal subject, *plus* Chemistry and Engineering as subsidiary subjects. The general scheme of degree and diploma courses is given below.

I.—*Ordinary B.Sc. Degree Course in Gas Engineering.*

The following is the synopsis of this course:—

First Year.

	Hours per Week.
Mathematics (Intermediate)	3
Physics Lectures II.	3
Chemistry (General Course)	3
Applied Mechanics	3
Physical Laboratory	3
Chemical Laboratory	12
Engineering Drawing and Laboratory	3

Second Year.

	Hours per Week.
Chemistry Lectures	3
Engineering Lectures	3
Chemistry of Gases Lectures	1
Physical Laboratory	3
Chemical Laboratory	6
Fuel and Metallurgical Laboratory	6
Mechanical Drawing and Engineering Laboratory	9

Third Year.

	Hours per Week.
LECTURE COURSES—	
Technology of Fuel	1
Coal-Gas Manufacture (second term)	2
Bye-Product Coking, six lectures during second term	
Gas Lighting and Heating (third term)	1
PRACTICAL WORK—	
Mechanical Drawing	6
Fuel and Metallurgical Laboratory	22 to 24

II.—*Honours B.Sc. Degree.*

Honours in Gas Engineering will be awarded to candidates who, having obtained the Ordinary degree as a principal subject, and being recommended as suitable to proceed with an Honours course, shall have spent one year in research, or in the preparation of a thesis on some industrial process, to the satisfaction of the examiners—attendance at the University during the fourth year not being compulsory.

III.—*Diplomas and Degree Courses for Post-Graduate Students.*

(*a*) A diploma in Gas Engineering will be awarded to graduates of this or some approved University who, having graduated in Science with Chemistry or Engineering as a principal subject, shall have attended for one year the prescribed course for the third year of the Ordinary degree course, and have passed an examination thereon.

(*b*) The degree of B.Sc. with honours may, in Gas Engineering, be conferred upon students who, having obtained the diploma under the provisions of the preceding section, shall have spent an additional year in research in the department, to the satisfaction of the examiners.

IV.—*Two-Years Courses for Non-Graduates.*

These courses are intended for students who, while not proposing to proceed to a degree, desire to take systematic instruction in Gas Engineering. Students entering for these courses must produce certificates of having passed either the matriculation examination, the Oxford or Cambridge local examination in Mathematics, the London University matriculation, or other approved examination, or they will be required to pass the following special entrance examination:—

Arithmetic.—The ordinary rules, including vulgar and decimal fractions, proportion, factors, H.C.F. and L.C.M., practice, square root, conversion from English to the metric system, averages, percentages, interest.

Algebra.—The ordinary rules, including fractions, brackets, simple equations with problems, H.C.F., and L.C.M.

Geometry.—The first book of Euclid or its equivalent, including riders.

Trigonometry.—Simple problems involving the trigonometrical ratios.

Every student is required to pass in each subject. The first year's course will be the same for all students; but the second may be differentiated according to individual requirements. Students who have passed satisfactorily through this two-years course may be permitted to enter for the diploma examination.

First Year.

	Hours per Week.
Mathematics, Physics, Chemistry } Intermediate Lectures	—
Chemical Laboratory	12
Physical Laboratory	3
Applied Mechanics or General Engineering Lectures *plus* three hours Mechanical Drawing and Engineering Laboratory.	

Second Year.

GAS ENGINEERING LECTURES—	
Chemistry	3
Technology of Fuel	1
Coal-Gas Manufacture (second term)	2
Bye-Product Coking (six lectures)	—
Gas Lighting and Heating (third term)	1
PRACTICAL WORK—	
Chemical Laboratory	6
Fuel Laboratory	12

The following is the

SYLLABUS OF THE LECTURE COURSES.

I.—*The Physical and Chemical Properties of Gases.*

[Tuesdays at 11.30 a.m. throughout the session.]

(*a*) Kinetic theory; fundamental gas laws; Van der Waal's equation; compressibility and liquefication of gases; the critical state; specific heats; dissociation; diffusion and transpiration; viscosity of gases; flow of gases through pipes; modern theories as to the nature and conditions of chemical changes in gaseous systems; velocity of reaction; chemical equilibrium; influence of moisture and surface in gas reactions; occlusion of gases by metals and the action of gases upon solids generally; principles of thermo-chemistry; gas calorimeters; heats of combustion of gases.

(*b*) The mechanism of combustion, &c.; slow combustion; ignition-points of gaseous mixtures; flames and explosions; the explosion wave; rates of explosion; the combustion of carbon, carbon monoxide, and cyanogen; the combustion of hydrogen and of hydrocarbons; the action of steam upon incandescent carbon; the reversible system $CO + OH_2 = CO_2 + H_2$; the action of CO upon metallic oxides; the thermal decomposition of hydrocarbons.

(*c*) Gas analysis and manipulation: Preparation of pure gases; use of liquid air for purification purposes; fractionation of gas mixtures; collection and storage of gas samples; solubilities of gases in liquids; principles of gas analysis.

II.—*The Technology of Fuel.*

[Tuesdays at 9.30 a.m. during the first two terms.]

Introductory: The mechanical theory of heat; specific and latent heats; calorimetry; heats of combustion of fuels; pyrometry.

Coal and its combustion; natural gas; petroleum; shale oil and oil fuels generally; the manufacture of coke in bye-product ovens; producer gas and its applications, including water gas.

III.—*Bye-Product Coking Processes.*

A course of lectures will be given during the second term by a specially appointed outside lecturer who is connected with the industry.

IV.—*The Manufacture and Distribution of Coal Gas.*

Arrangements are being made for the delivery of a special course of lectures in this subject by a well-known gentleman connected with the industry.

V.—*Gas Lighting and Heating.*

[Tuesdays at 9.30 a.m. during the third term.]

The nature and structure of hydrocarbon flames; theories of luminosity; types of gas-burners; the bunsen burner; gas-stoves; theory of the incandescent mantle; acetylene as an illuminant; photometry and spectrometry.

Fuel and Metallurgical Laboratory.

The newly-erected and equipped laboratories will be open during the session from 9.30 a.m. to 1 p.m., and from 2 to 5 p.m., except on Saturday afternoons. The equipment will include a complete installation of recording electrical and optical pyrometers by the Cambridge Scientific Instrument Company; a Boys gas-calorimeter and a Berthelot-Mahler bomb calorimeter; special apparatus for both commercial and refined methods of gas analysis and manipulation; experimental gas-compressing plant, capable of compressing 30 cubic feet of gas per hour up to 200 atmospheres pressure, by Messrs. C. W. Cook and Co., of Manchester; special apparatus for research work on gaseous combustion and catalytic gas reactions and on gaseous explosions under high pressures, including a pump for compressing small volumes of pure gases up to 100 atmospheres; and a complete photometric outfit, including a 12-feet photometer bar and a Harcourt 10-candle pentane standard, by Messrs. Alexander Wright and Co., of Westminster. The research students of the department will also have the use of a machine for producing liquid air, now being erected in the Chemical Department of the University.

A fully-equipped workshop, with a mechanic in charge, will be provided in the new building. The equipment will provide for instruction and research in the following subjects: (*a*) Gas analysis, photometry, and spectrometry; gas calorimetry; gaseous combustion and explosions; the chemistry of gas production; testing of gas coals; and experiments with gases under high pressures, including the compression and liquefaction of gases; (*b*) the analysis and testing of coals.

Special courses for outside students in any of the above subjects can be provided by arrangement with the professor; and every facility will be afforded to properly qualified persons who may wish to undertake research work in connection with industrial processes. Arrangements will be made enabling regular students of the department to carry out efficiency trials of gas-producer plants, &c.; and help will be given to those who desire to gain practical experience in works during the summer months.

THE RESEARCH FELLOWSHIP.

The Institution of Gas Engineers have generously decided, as our readers are aware, to support the research work of the department by establishing an open Fellowship for gas research under the following conditions.

1.—The Fellowship, of the value of £100 per annum, shall be awarded by the Senate, on the recommendation of the Board of Science and Technology, to a duly qualified candidate for the prosecution of post-graduate research in gas chemistry. Preference shall be given to candidates who have signified their intention of entering the coal gas industry, or, in default of any such candidate, to a person qualifying for some other branch of fuel industry.

2.—The award of the Fellowship shall be made annually during the month of June, after due advertisement of it in the Technical Press and other appropriate journals. Applications for the Fellowship to be made to the Registrar of the University on or before May 1 of each year. [Applications for the Fellowship for the session 1907-8 should be sent in to the Registrar of the University, on or before Saturday the 10th prox. The award will be made on or before Aug. 31, and the successful applicant may begin his work during September, according to the state of equipment of the laboratories.]

3.—It shall always be within the power of the Senate, on the recommendation of the Board of Science and Technology, to renew the Fellowship to the holder of the same for a further period of a year, instead of proceeding to a fresh election.

4.—The holder of the Fellowship shall undertake research work in the University under the direction of the Professor of Fuel and Metallurgy on some subject connected with the chemistry of gases and combustion. The selection of the subject and the method of carrying on the work shall be left to the judgment of the Professor responsible for its direction.

5.—The University shall provide, free of charge, all reasonable accommodation and facilities required for the prosecution of the research undertaken by the holder of the Fellowship, including working space and the use of the instruments and appliances installed as part of the equipment of the Fuel and Metallurgical Department. The Institution of Gas Engineers will be prepared to contribute a sum not exceeding £25 per annum towards the special expense of the research.

6.—A report of the research work carried out by the holder of the Fellowship shall be submitted to the Council of the Institution of Gas Engineers, as well as to the Senate of the University, on or before May 1 of each year, together with copies of any papers published in connection with the research.

It only remains to say that Professor Bone will be in Leeds from the middle of August onwards, and will be glad to confer personally with intending students, or to advise them by correspondence as to their courses.

A GERMAN GAS MANUAL.*

We had the pleasure, in October, 1903 [see "Journal," Vol. LXXXIV., p. 96] of recording our favourable impressions of an advance proof of the first edition of Herr Schäfer's manual on the "Construction and Working of Gas-Works." The second edition, which is now before us, is a much larger and more pretentious work; and we are disposed to think that the author might with advantage have reduced its bulk by omitting those of the illustrations which appropriately find a place in general text-books of chemistry and engineering. For instance, Herr Schäfer gives illustrations of the ordinary laboratory desiccator and the triangle for supporting a crucible, which are used in every branch of chemical analysis. It would be as reasonable to cumber a book on gas-works with pictures of a funnel and a hammer, because they too are used on the works! The writer of a manual on a special technical subject should assume that his readers have some general knowledge of the more elementary facts and apparatus of the sciences and arts which are applied in it, or that they have access to common text-books which will impart that knowledge. Otherwise his manual must inevitably become too voluminous for convenience; and the large majority of those who start to study it will soon begin to skip portions dealing with matters with which the general treatises have familiarized them. The skipping process, when once started, will be extended until important special information is inadvertently passed over unnoticed. The modern craze for embellishing text-books with illustrations is responsible for much mischief. No objection can be raised when they are necessary to the proper understanding of the subject, and are therefore relevant; but often too much attention is given to the mere assembling of a large number of pretty pictures to adorn the text, and little or no regard is paid to utility or relevance. We think Herr Schäfer has erred seriously in this respect in the new edition of his manual, which has 345 illustrations distributed through its pages, as well as 11 large plates. The first edition, with only 185 illustrations and 6 plates, was decidedly handier, and we think little less useful.

Having now stated the most obvious objection, from our point of view, to the work before us, we may indicate more particularly its scope and purpose. It contains eighteen chapters, of which the first, comprising 91 pages, treats of coal. The greater part of this chapter is devoted to the testing of coal, and the information given is good, if not strikingly original. The treatment accorded to the carbonization of coal is useful; and Witzeck's instructive diagrams on the distribution of ammonia, cyanogen, and sulphur in the gas made from hour to hour in the carbonization of Saar coal and Durham coal are reproduced. The generalizations here attempted are, however, at times too broad; and for this or other reason, contradictions appear. For instance, one table gives the average yield of gas per 100 kilos. of either English or Saar coal as 30·5 cubic metres, which is equivalent to 10,944 cubic feet per ton; while another table gives the average yield of gas from English coal at 27·5 cubic metres per 100 kilos. (9868 cubic feet per ton), and from Saar coal at 28 cubic metres per 100 kilos. (10,047 cubic feet per ton). There is no indication that the difference in yield of gas is due to differences in the conditions of carbonization; and there is no doubt that the contradictory statements arise from too broad a generalization having been made from the data at command. A few specific examples of the yields from well-defined varieties of English or other coal under specified conditions would have been more serviceable than these indefinite so-called averages. The first chapter concludes with a section on the efficiency of the carbonization process, based on Mahler's classical research on the calorific balance of the carbonization of Commentry coal. The author continues, as in his first edition, to ignore Euchêne's later and more exhaustive investigations in the same field.

The second chapter deals with retort-settings. About 30 pages are devoted to a discussion of the thermal conditions which prevail in retort-furnaces—direct-fired, producer, and recuperative; and this portion is good. Then follow about as many pages on the construction of the various forms of settings, including the Dessau vertical retort-settings, with which the author does not appear to have any special acquaintance. Means of controlling the heats of the settings are then described; and incidentally pictures of men gazing into optical pyrometers are introduced. The chapter concludes with a section on charging and discharging machines (of which the Eitle and De Brouwer are accorded the fullest notice), and a few paragraphs in regard to the scurfing of retorts.

Chapter III. deals with coal and coke conveying plant, and is necessarily rather sketchy, though most of the types of apparatus in use are described. The advantages and disadvantages of the different appliances are not, however, adequately indicated. It is here, perhaps, that the author's disinclination to discuss the merits of the various pieces of apparatus which he mentions is most noticeable; and the student will look in vain for that guidance which the practical experience of the more competent writers of text-books should afford him. The fourth chapter is comparatively short, and deals with condensers; the fifth, also short, describes exhausters and governors. Tar-extractors and tar and liquor wells form the subjects of the sixth chapter. The Pelouze extractor is the only one exhaustively described. The seventh chapter is somewhat novel, as it is entirely devoted to the question of the removal of naphthalene from coal gas. After prefatory remarks on the subject in general, the author describes three methods of avoiding or reducing naphthalene troubles—viz., (1) Very gradual condensation of the gas, so that that the tar vesicles in settling out take with them the naphthalene; (2) washing the gas with heavy tar-oils; and (3) volatilizing xylene or a suitable grade of coal-tar naphtha into the gas, preferably before it enters the condensers. No definite results are quoted by the author to prove the efficacy of the first means; the second depends on the choice of a suitable washing oil; and the third entails careful selection of the xylene, and its employment is frequently attended by injury to the membranes of gas-meters. Though naturally no satisfactory solution of the naphthalene question is afforded the presentation of the facts in regard to it and the more rational remedial suggestions, in an independent chapter, is distinctly a welcome feature of Herr Schäfer's manual.

Chapter VIII. treats of washers, and the estimation of ammonia in gas, and is followed by a chapter on gas liquor, and the manufacture therefrom of sulphate of ammonia, concentrated liquor, and liquor ammoniæ. The tenth chapter deals with purification, which in German gas-works practice implies only the application of hydrated oxide of iron for the removal of sulphuretted hydrogen and cyanogen. Lime as a purifying material is only curtly mentioned as being applied in some instances where highly sulphurous English coal is carbonized. Washing the gas with solution of ferrous sulphate for the extraction of cyanogen is described, and its first successful application is attributed to Dr. Bueb. We can, however, detect no essential difference between this washing process as described and that which was very extensively used in London prior to Bueb's claim. The independent anterior washer-scrubber is common to the two; and the strength of the cyanogen sludge in both blue and ammonia is, we believe, practically identical. The streugth is stated by Herr Schäfer to be (for the Bueb sludge) 14 per cent. of prussian blue, and from 6 to 7 per cent. of ammonia—that is to say, the ammoniacal strength of the cyanogen liquor is about 28 to 32 oz. The author, however, now speaks of the washing process as scarcely remunerative if the gas-works have to sell the sludge as such. Undoubtedly where the process is used, the sludge should be worked up for blue and ammonia on the spot. This means that in most cases it can only be economically adopted by relatively large gas-works.

Chapter XI. is devoted to the station-meter, and Chapter XII.

* "Einrichtung und Betrieb eines Gaswerkes." "Ein Leitfaden für Betriebsleiter und Konstrukteure bearbeitet von A. Schäfer, Direktor des städt Gas-und Wasserwerks zu Ingolstadt." Second Edition. R. Oldenbourg. Munich and Berlin; 1907.

to the gasholder. The enclosing of the holder in a building, which was at one time the general practice in Germany and Austria, is spoken of by the author as though discarded; but certainly a number of large holders enclosed in houses have been erected on the Continent within the last ten years. We are not defending the practice, but merely pointing out that it must be considered as still obtaining. It is, of course, impossible for the author to treat exhaustively of gasholder construction within a compass of a little over 30 pages; but he is helped by the fact that in Germany standard dimensions of parts have been agreed upon for holders of 39 capacities, ranging from a single-lift holder of 400 cubic metres (14,125 cubic feet) to a three-lift holder of 50,000 cubic metres (1,765,000 cubic feet). His treatment, within the limitations of his space and of German practice in gasholder construction, is most decidedly good. Then follows a short chapter on governors, and afterwards 37 pages on water gas.

Of the four systems of water-gas manufacture described, most space (ignoring illustrations) is devoted to the Dellwik-Fleischer and the Kramers and Aarts processes, and appreciably less to the Humphreys and Glasgow and the Strache systems. For the Dellwik-Fleischer plant, results obtained at the Königsberg Gas-Works are quoted; and for the Humphreys and Glasgow plant figures are given from the Bremen Gas-Works. We do not think these two sets of figures are fairly comparable; but it is difficult to get a satisfactory comparison if German works only are referred to. German conditions are most unfavourable to the Lowe type of carburetted water-gas plant, because suitable gas-oil is only obtainable at an almost prohibitive price, owing to the heavy duty imposed on imported petroleum. The native gas-oils are distinctly inferior. Strangely enough, the author does not discriminate between the different classes of oils. The consumption of oil in the Bremen water-gas plant is stated without any indication being given of its origin, nature, density, or calorific power, though detailed information is furnished as to the coke used in the generator. Obviously, such figures must be regarded as useless.

The next or fifteenth chapter is somewhat of a novelty, as it is devoted to the supply of gas to a distance—that is to say, high-pressure distribution. But one gets the impression from reading it that the author's knowledge of the matter is mainly theoretical; and theories relating to the distribution of gas are never sufficiently comprehensive to cover all the manifold influences which come into play when gas is propelled through a pipe under considerable pressure.

The sixteenth chapter deals with physical and chemical means of checking the operations on a gas-works. It comprises 125 pages, and includes the measurement of pressure, gas analysis, and the calorimetry and photometry and the determination of the specific gravity of gas. Limitations of our space preclude a detailed criticism of this chapter; and it will suffice to say that it is good, but would require considerable modification for the ready use of English photometricians and gas analysts. The seventeenth chapter is on distribution, and most of its contents will seem very familiar to readers of other text-books on gas supply. The eighteenth, and final, chapter is a brief one, treating of the computation of the proper dimensions for a gas-works, and is obviously theoretical and Continental. A few tables and an inadequate index complete a manual which has many merits, and deserves a place, as a compendium on modern Continental practice in gas manufacture and supply, in the book-shelves of every gas manager who has mastered the language in which it is written. Needless to say, it is, like most German technical works, in Roman type and well printed and finished.

Society of Chemical Industry.

The Annual Meeting of the Society was held last Wednesday in the Medical Theatre of the University of Birmingham, under the presidency of Mr. Eustace Carey, of Liverpool. Among those present were Sir Boverton Redwood, the President-elect, and Professor Percy F. Frankland, the Chairman of the Birmingham and Midland Section of the Society. The Lord Mayor (Mr. H. J. Sayer) welcomed the members on behalf of the city, and Sir Oliver Lodge as representing the University. The President acknowledged the welcome, and formally announced that the King had been pleased to grant the Society a Royal Charter. He said they owed their grateful thanks to the Committee of the Council who had had this matter in hand, and especially to the Chairman of the Committee, Sir Boverton Redwood. In their report, the Council stated that the number of members on the register is 4519, compared with 4429 last year. The report presented by the Hon. Treasurer (Mr. S. Hall) showed an income of £6495 and an expenditure of £6109; leaving a balance of £386. The reports having been received, the President proceeded to deliver his Inaugural Address, in which he dealt with the causes of commercial depression, our neglected canals, and the labour and higher education questions. On the motion of Sir Boverton Redwood, seconded by Professor Frankland, the President was cordially thanked for his address. It was decided to hold the next annual meeting in Newcastle-upon-Tyne. In the afternoon, visits were paid to local works; and subsequently a reception was held at the new University buildings. Thursday and Friday were devoted to visits, one of which was to the Saltley Gas-Works.

MR. BREARLEY'S PAPER ON THE TESTING AND HYGIENIC EFFICIENCY OF GAS-FIRES.

We have received from Mr. Walter T. Dunn, the Secretary of the Institution of Gas Engineers, the following written remarks by Drs. Des Vœux and Owens regarding the paper, on the "Testing and Hygienic Efficiency of Gas-Fires," which Mr. J. H. Brearley read at the recent Dublin meeting of the Institution ["Journal," June 25, p. 946]. At the same time, Mr. Dunn has forwarded a copy of Mr. Brearley's reply to the points raised.

Westminster, June 18, 1907.

Sir,—As Mr. Brearley was kind enough to send us copies of his paper on the "Testing and Hygienic Efficiency of Gas-Fires," which we have read with great interest, and as we notice that he refers to the tests which we conducted for the Coal Smoke Abatement Society, we think it may be of interest to the Institution if we make a few remarks thereon.

Tests for Radiation.—Speaking generally, we have come to the same conclusion as Mr. Brearley—*i.e.*, that of the various methods used up to now, the thermopile and galvanometer give the most reliable comparative results. We used this method in the last tests of solid smokeless fuels; and we are interested to note that one of the conclusions arrived at by Mr. Brearley is different from ours. We found that the maximum reading of the galvanometer was obtained on a line from the fire making an angle of about 45° with the horizontal; whereas Mr. Brearley found the maximum on the horizontal. What we really want, however, is a sound quantitative method of measuring the amount of heat given off as radiation. The thermopile is useless for this purpose, as it only gives comparative results. We found in the above tests that the results obtained from the thermopile readings corresponded fairly accurately with those obtained by means of thermometers.

Testing for Heat Lost in Flue Gases.—As Mr. Brearley remarks, no perfectly satisfactory method has yet been arrived at. We do not think the calorimeter method is a solution of the difficulty. Some of the heat given to the walls of the flue is returned to the room through the walls; some is given to other rooms in the building; and the only heat actually lost is what passes out from the top of the chimney. It was at this point, therefore, that we estimated the loss. There is, of course, some loss by conduction through, and radiation from, the walls of the building; but this is difficult to measure. No doubt it would be interesting and useful to measure the amount of heat passed into the chimney, as well as that passed out. The impossibility of taking out of the flue gases, by means of a calorimeter, just the amount of heat given to them by the fire, and not a greater or less quantity, and, secondly, the interference of the calorimeter with the natural draught in the flue, inclines us to the view that the direct measurement of the quantity of the flue gases and their temperature—when carefully and accurately done—is the soundest method of arriving at the heat carried off in the flue.

In the paper, reference is made to the escape of products of combustion into the room; and it is suggested that the reason that such escape did not occur during the Coal Smoke Abatement Society's tests, except in a few cases, was the fact of the chimneys being 68 feet instead of 22 feet long, as in Mr. Brearley's tests. We think, however, that the explanation is to be found elsewhere. On Table IV., column 5, is given a list of stove-pipe areas; and reference to this will show these were exceptionally small. One stove, consuming 10·6 cubic feet of gas per hour, was provided with a pipe of only $\frac{3}{4}$-inch diameter to carry off the products of combustion; and a stove consuming 24·1 cubic feet of gas, a pipe of $1\frac{1}{2}$ inches in diameter. We think such pipes are too small to carry away all the waste products. In our tests, the minimum diameter of stove pipe was 3 inches.

Carbon Monoxide Test.—It may be taken as fairly established that practically no CO is to be detected in the flue gases from a good gas-fire. We have read with interest Mr. Brearley's experience with the iodine pentoxide test. Testing flue gases for CO is not the same as testing air, and a method useful in one case may be useless in the other. Great caution is required in applying the above test. For example, the presence of sulphur in the flue gases will, unless carefully provided against, invalidate the I_2O_5 test, since, though CO may set free the I from the I_2O_5; on the other hand, SO_2 in the presence of water reacts with it to form hydriodic acid and sulphuric acid. The respective formulæ are as follows:—

$$(1)\quad I_2O_5 + 5CO = I_2 + 5CO_2$$

$$(2)\quad SO_2 + I_2 + 2H_2O = 2HI + H_2SO_4$$

Humidity.—This is a very difficult subject, and one which, we think, is not thoroughly understood in its relation to gas-fires. From the results of several series of tests of coal, coke, gas, and other fuels, we have come to the conclusion that the fire, except as a source of heat, plays a very small part in determining the humidity of a room. On collecting all these results, a curious fact at once came to light—that is, that in every case the amount of water in the air of the room was increased by the fire, though the humidity was in most cases reduced. Taking the results of Mr. Brearley's tests, in every case given in Table V. the amount of water is increased by something like 2 grains per cubic foot at

4 p.m. as compared with 10 a.m. This result is obtained from the temperature and humidity given for each fire. The humidity, therefore, appears rather to depend on whether there is a sufficient supply of water to the room air as it becomes heated (in the absence of which there must be a reduction of humidity) than on any peculiarity in the fire itself.

(Signed) H. A. Des Vœux, M.D.
John S. Owens, M.D., Assoc.M.Inst.C.E.

MR. BREARLEY'S REPLY.

Longwood, July 8, 1907.

As it was impossible to take note of the criticism of Drs. Des Vœux and Owens at the meeting of the Institution, and at the same time afford members an adequate opportunity for discussion, their interesting communication has been left over. It contains, however, little that is adverse, though there are two or three points that call for notice from the author.

Testing for Radiation.—The postponement of this reply has enabled the author to carry out some further observations on other "makes" of gas-fires than those referred to in his paper; and the maximum reading has again been invariably in a horizontal plane with the hottest part of the fire under test. The fact that Drs. Des Vœux and Owens obtained the maximum reading (when testing solid fuel) at an angle of 45° with the horizontal, is probably accounted for by the greater depth (front to back) of the fuel used in their tests, and to the great variation there must be in the angle of the surface of heated substance of a solid as distinguished from a gaseous fire. The heated exposed surface of a gas-fire, particularly of the shallow type, is chiefly vertical; while if one takes the ordinary coal-fire as typical of a solid fire, the most intense surface varies from the horizontal to an angle of (say) 45°. With fuller details of the types of stoves in which Drs. Des Vœux and Owens made their tests on solid fuel, there is no doubt that the difference in the angle of greatest intensity would be satisfactorily explained in this way.

The author agrees that a really sound quantitative method of measuring the amount of heat given off by radiation is needed; and now that the use of the thermopile and galvanometer in this connection has been made more widely known, it is probable that, even with these instruments, such a quantitative method will ultimately be evolved.

Testing for Heat Lost in Flue Gases.—The remarks made by Drs. Des Vœux and Owens on this head are mostly anticipated in the paper, and the reply to the discussion thereon. The author did not seek to arrive at the amount of heat "carried away by the flue," but to evolve a method of comparing fires in the function of "pouring" heat into the flue. It is true that, in actual use, a portion of the heat passed into a flue is returned to the room in which it is generated, by conduction through the walls of the flue; but the difficulty of correctly comparing stoves under these conditions is fully dwelt upon in the paper. The author believes that the draught from the fire is not interfered with by the calorimeter, for the reason given in his reply on the discussion. It is not impossible, as the Doctors seem to imply, to measure accurately the heat passing from the stove flue-pipe to the calorimeter. Though the latter does not extract all, the quantity left in the waste gases can be accurately calculated by the method described.

The author is at one with Drs. Des Vœux and Owens as to the faulty proportioning of stove-pipe areas. It is eminently desirable that further research into this phase of the subject should be made.

Carbon Monoxide Test.—The criticism on this head hardly applies, for it is shown that—

(*a*) If SO_2 is present in the sample of flue gases taken, it is removed by NaOH.
(*b*) H_2O is removed by H_2SO_4.

If, in spite of these precautions, it be assumed that the presence of SO_2 caused the formation of HI as indicated by them, then in presence of excess I_2O_5, iodine would be produced, thus—

$$10HI + I_2O_5 = 5H_2O + 12I.$$

This reaction usually takes some time for completion; but, under the conditions of the experiments made, as recorded in the paper, it could be considered as practically instantaneous. It need hardly be said that, under the conditions of the test, it was quite impossible for SO_2 to pass forward to the U-tube containing the iodine pentoxide.

In conclusion, the author wishes to express his sincere appreciation of the courteous manner in which Drs. Des Vœux and Owens have expressed their views; and though differing from him on matters of detail, he believes that their observations, as well as their exhaustive practical work on this subject, is prompted with the earnest desire to see heating by gas as successful as its own advocates within the gas profession would have it.

(Signed) J. H. Brearley.

Mr. Daniel William Hill, of Pinner, a Director of the Watford Gas and Coke Company, left £55,903.

The Scottish Junior Gas Association—Eastern District—held their annual excursion last Saturday, to Raith Grounds, Kirkcaldy, the property of Mr. R. C. Munro Ferguson, M.P. About forty attended. The afternoon was unfortunately wet, which necessitated a programme of sports being stopped. After tea in a restaurant in Kirkcaldy, the sights of the place were visited, and a call was made at the gas-works.

THE CENTENARY OF GAS LIGHTING.

(*Continued from p.* 91.)

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In the year 1859, the companies on the north side, profiting by the experiences of their *confrères* on the Surrey side, entered into an arrangement for terminating their competition, and divided the Northern Metropolis into districts, upon the principle of exclusive supply. The effect of this on the price of gas was that the very companies who had been formed from the consumers and ratepayers, and who had succeeded so well in their object, now that they felt the keenness of the competition they had brought about, immediately put up the price of gas from 4s. to 4s. 6d. per 1000 cubic feet, at which figure it stood until 1860.

In 1854, Dr. Henry Letheby, M.B., Professor of Chemistry and Toxicology in the London Hospital, presented a long treatise to the authorities on "Coal Gas supplied to London, with Examples of Injury done to Books, &c., by the Products of Combustion." The companies particularly concerned were the Great Central, which supplied the whole of the City, the Chartered of Brick Lane and Curtain Road, the City Company, which supplied the south of the City, the Commercial Company, and the Compauy which sent cannel gas to "The Times" Office and the General Post Office. The paper seems to have arisen out of complaints as to the destruction caused to books and furniture, and the alleged danger to health evidently caused by want of a proper system of ventilation in places where gas was burnt. The treatise, which extends over 21 pages, and is full of tables, deals exhaustively with the whole question of gas products and purification as known at that date. Dr. Letheby, who was an authority on photometry, likewise went into the question of illuminating power. It is interesting to know the value in illuminating power both in sperm and wax candles, of the various compauies.

—	Equal to	Equal to
City cannel gas	13·7 sperm candles	15·6 wax candles
City Gas Company	13·5 ,, ,,	15·5 ,, ,,
Great Central Company	13·0 ,, ,,	14·9 ,, ,,
Chartered Company of Curtain Road	12·9 ,, ,,	14·7 ,, ,,
Commercial Company	12·9 ,, ,,	14·4 ,, ,,
Chartered Company of Brick Lane	12·2 ,, ,,	13·9 ,, ,,

Another point to which the Doctor directed attention was the pressure. "This," says he, "is of importance, because, when the pressure is low, the street lights, and even the lights of our houses, are insufficient for the purposes required." The writer did not think that gas should ever be delivered at less than an inch of water pressure. The following table, which was founded on 160 observations, gives the pressures of the various companies, and shows the Chartered Company giving gas at very low pressure, which, in these days of high-power lighting and heating, would be out of the question.

	Least Pressure Observed.	Greatest Pressure Observed.	Average Pressure per Quarter.
	Inches of Water.	Inches of Water.	Inches of Water.
City Company	1·5	2·2	1·8
Great Central Company	1·0	1·8	1·3
Commercial Company	0·8	1·1	0·9
Chartered Company of Brick Lane	0·6	1·2	0·8
Chartered Company of Curtain Road	0·4	1·0	0·7
Cannel gas, after passing through Leslie's governor	0·2	0·4	0·3

The paper further dealt with impurities. Specimens of the "soil of the Metropolis infected by tar," and examples of injury done to copper and brass fittings by ammonia, accompanied the report. Proceeding, Dr. Letheby states: "It has been thought by some persons who are unacquainted with the action of poisons on the living system, that because tar happens to have the power of checking putrefaction, it cannot exert any injurious action on the living body. But it might be easily shown that the two effects are perfectly distinct; the one being an action on the dead body, the other on the living. Besides which, it is known to all toxicologists that the most powerful antiseptics are the most powerful poisons." The other impurity mentioned was bisulphuret of carbon. Mr. Lewis Thompson had stated that "bisulphuret of carbon is a constant ingredient of coal gas which seldom contains less than a thousandth part of its bulk." Dr. Letheby controverted this, and said: "If this were true, as much as 2977 grains, or nearly one-third of a pound, of anhydrous sulphuric acid would be produced by the combustion of 1000 cubic feet of gas. My own experiments have not furnished me with anything like so enormous a result; and though they are amply sufficient to illustrate the pernicious effects of such a powerfully corrosive agent, yet they do not, on the average, give me much more than one-twentieth part of Mr. Thompson's frightful amount." The average amount of sulphuric acid on 46 experiments was 142 grains per 1000 cubic feet.

Specimens of products collected from the burning of gas through

a Leslie burner, and samples of water from the Athenæum Club House produced by the combustion of gas in the hall of that establishment, and condensed in the cistern of the ventilating pipe designed by Faraday some years previously, accompanied this treatise, to show the effect upon metal articles of products from gas as it was then purified. Specimens were also furnished by "Mr. Faraday, of Wardour Street," and the Librarian of the Athenæum. Mr. Thornhill, of the Literary and Philosophical Society of Newcastle-on-Tyne, stated that where they had fitted up four ventilators over the chandeliers in the room, "as much as half-a-gallon of water is collected of a night from the gas burnt there—this water being so corrosive from the presence of sulphuric acid, that it attacks all the metal fittings with which it comes into contact." At other places also the books were stated to have suffered severely.

Dr. Letheby says: "Within the last day or two, I have visited the library of the Royal College of Surgeons, in Lincoln's Inn Fields; and though gas is not regularly burnt therein, yet it is surprising to see how much mischief has been done to the bindings of the books by the products of gas consumption. I should think that in the gallery of the Institution there are hundreds, if not thousands, of books the backs of which are completely rotten. . . . . It may be asked whether I can suggest any remedy for the evil. I reply that the remedy is threefold: (1) In respect of the manufacture of gas. (2) As regards its purification. (3) In a more perfect system of ventilation." Dr. Letheby recommended that all gas should be burnt outside the room or shop, whenever practicable; and when this was not so, the products of combustion should be conveyed away as speedily as possible. They ought not, he added, to be allowed to escape into the room at all. "I am sure," says the learned Chemist, in conclusion, "that many elegant arrangements may be suggested for this purpose."

The statements of Dr. Letheby were not allowed to go unchallenged; for a closely printed pamphlet was issued by the Directors of the Chartered Company, they having commissioned two eminent scientists—Dr. Leeson and Mr. R. Warmington—who reported upon "certain inaccuracies" and "exaggerated expressions," which were calculated greatly to mislead and alarm the public—however manifest it might be to the few—scientifically acquainted with the subject that so large a quantity of "oil of vitriol," or "vitriolic acid" could not possibly result from the ordinary combustion of coal gas. They believed that the "oil of vitriol" had been manufactured from gas, not produced by the ordinary method of consumption, but by a process adopted for these experiments. They added: "We might, indeed, suggest such a multitude of contaminating influences in this great Metropolis, that even Dr. Letheby's fearful tale would sink into utter insignificance." About this time, Mr. J. O. N. Rutter, of Brighton, issued an admirable little treatise on the "Advantages of Coal Gas in Private Houses," especially affording help and information regarding the understanding of the gas-meter.

In the month of February, 1855, Mr. John Simon, writing from Upper Grosvenor Street, went very fully into the complaints of nuisance from the London Gas-Works. He dealt with the whole process of purification as then carried out by the gas companies, and particularly with the "blue billy," the discharge of which into the Thames was regarded in the light of a common nuisance. In the City Gas-Works, it appears, wet-lime purifiers were in use. The gas "bubbled through great churning tubs of milk of lime, leaving in them its sulphuretted hydrogen, combined into sulphuret of calcium." These, being of no commercial value, were, at certain states of the tide, discharged at night into the middle of the river. The Company, however, in consequence of legal proceedings, pledged themselves to an abatement of the nuisance, and completed a system of dry-lime purification; and this giving a cartable refuse, they no longer polluted the river.

Early in 1860, Dr. Letheby reporting on experiments on the illuminating power and chemical quality of the gas supplied during the preceding eight years, mentioned the using of sperm candles in addition to wax. He said: "It is very difficult to secure the uniformity of proper consumption of wax in testing the illuminating power of gas. It is most convenient to use sperm in the experiment, and then to calculate its value into wax." In the same year, Dr. Letheby, in a voluminous statement on the injurious effects of gas leakage into the earth, owing to complaints brought by the New River Company, remarked that for some time past attention had been directed to the serious damage done to the street-mains by the rapid corrosion of the iron and its conversion into a soft plumbago-like substance. This change had only been observed in those localities where the soil had become tainted with gas, and where the earth had acquired those black and foetid qualities which were so well known to the inhabitants of London. Instead of resisting decay for more than a century, when brought into contact with the black soil of the Metropolitan streets, saturated with gas, the pipes rapidly decayed, and were "rotten in about ten years." Associated with Mr. Letheby was Mr. Spencer, an eminent Chemist, who had devoted much time to the subject of the action of the soil on street mains. In this pamphlet, mention is made of such distinguished authorities as Kastner, Vogel, Döbereiner, Henry, Bischof, Daniell, Ginelin, and others who had made special inquiries into the matter.

Dr. Letheby stated in 1860 that the amount of gas escaping into the earth in the Metropolis was no less than 386,000,000 cubic feet per annum. Mr. Spencer calculated it as twice this quantity, and put the total loss at 9 per cent. of all the gas distributed; whereas Mr. Wright put it at 5 per cent. According to Mr. Spencer, in round figures, about 630,000,000 cubic feet of gas was annually absorbed into the street earth of the Metropolis, which it was stated, "darkens the soil, and makes it so offensive that the emanations from it can hardly be endured, renders the basement rooms of houses uninhabitable from the poisonous action of the gas, and even dangerous from explosions, and taints the water with filthy odour." At the rate of 1s. 6d. per 1000 cubic feet, the then cost price of gas, "the loss is more than £47,000 per annum." The remedy for this mischief was given as twofold—(1) To supply gas freer from ammonia and sulphur compounds; (2) the use of tighter joints. Already in some of the large towns of England (as in Liverpool, Manchester, and Leeds) the latter remedy had been applied; the ends of the pipes being turned and bored and fitted into each other by grinding "like a stopper into a bottle."

Thus handicapped with competition that was absorbing its capital and ruining its shareholders, and struggling with an imperfect knowledge of purification, and without a market for the disposal of its residuals, the gas industry made but slow progress during these last twenty years, until the districting already mentioned set in, putting gas up 6d. per 1000 cubic feet. The raising of the price to 4s. 6d. caused an agitation to break out again. Complaints from local bodies and other consumers resulted in an inquiry being made as far as the Metropolis was concerned, which ended in the passing of the Metropolis Gas Act, 1860. The Bill was originally proposed by delegates from the gas consumers and authorities of the Metropolis, who, attended by a large array of Counsel, Parliamentary Agents, and Solicitors, were engaged before a Select Committee of the House of Commons for thirty days discussing its principles and details. It was introduced into Parliament quite early in 1860, and on April 2 was referred to a Special Committee of the House of Commons, consisting of the Right Hon. J. Sotheron Estcourt (Chairman), Mr. Packe, Mr. North, Mr. Turner, and Lord Robert Cecil, who, after hearing evidence for many days, arrived at certain decisions, on June 18, which were apparently so favourable to the public, and so distasteful to the gas companies, that the latter withdrew altogether from before the Committee, who concluded their labours on June 25. The companies, however, were so successful in their opposition to the Bill on its third reading, that they obtained its re-committal. The Committee to whom it was referred did not meet again until the middle of July (a very late period of the session); and ultimately the Act passed in its present shape—the companies having obtained the withdrawal from it of those features which they considered prejudicial to their interests. Parliament, therefore, appears to have confirmed Mr. Robert Stevenson in the opinion that, by a well-regulated exclusive trade, gas consumers might be better and more cheaply supplied than by rival companies carrying on businesses with all the changes and losses which a state of rivalry produces.

In this Act, a price was fixed of 4s. 6d. per 1000 cubic feet for 12-candle gas; but the charge could be raised, on appeal to the Home Secretary, up to 5s. 6d. The districting was also legalized, so that competition was killed. The abolition of competition sanctioned by this Act, the fixing of the minimum price at 4s. 6d. for common gas of 12 sperm candles, and the increased consumption caused the companies to be very prosperous, excepting, perhaps, the Chartered Gas Company. The companies were paying full dividends (10 per cent.); and the Act permitted them to pay back-dividends over a large number of non-prosperous years. This system encouraged the wasteful expenditure of capital. As new capital was allotted at par to the shareholders, it was only natural they should be clamorous for stock on such favourable terms, and with such authorized dividends. Thus no inducement was offered to reduce the price of gas.

On Dec. 16, 1861, a 30-page closely written pamphlet was issued by the Chairman of the Central Consumers' Company, Mr. Thomas Dakin, in reply to the agitation against the increase of gas to 4s. 6d. The pamphlet dealt with the remarkable history of the Company—how the project "was received with the greatest enthusiasm, 9200 citizens signing a petition in its favour." Then the sad story was related of how the petitioners not only broke their promises to take gas, but gave the shares of the Company the cold shoulder, so that the Directors "were obliged to go to an improvident market and arrange with contractors to take shares in payment for works." Buoyed up by the enthusiasm of the public, and misled by the over-sanguine expectations, the Company, states the pamphlet, contracted for the erection of buildings equal to the manufacture of 500 million cubic feet of gas, and for the laying of mains from Bow, necessary to distribute twice that quantity; and when the works were completed they discovered that their friends declined to give them their custom. As the old companies reduced to 4s., "it was natural, being satisfied, they were unwilling to change, and that gratitude for past services had little place in the commercial vocabulary." It appeared that the maximum output had only been 277,640,000 cubic feet for one year; and this had only "been arrived at with great effort." The pamphlet went on to state that the Metropolis Gas Act of 1860, under which they were now working, compelled a minimum illuminating power of 12 sperm candles, instead of 12 wax candles as before—an increase of 14 per cent.—with a penalty on failure of £50 for each offence, and £10 a day for its continuance. "How, then, I ask," says the Chairman of the Company, "can it be with any shadow

of truth alleged that, in carrying out the Act of 1860, we have broken faith in charging an additional 6d. per 1000 feet?"

Among various petitions presented at this time to the local authorities against gas companies under the 1860 Act, was one which stated that the Act gave the companies power to raise the price from 4s. 6d. to 5s. 6d. for common gas, and from 6s. to 7s. for cannel gas, and to change the gas at their own discretion.

The Chairman of the Great Central Company was quick to point out that the Act particularly prevented them from raising the price beyond 4s. 6d. The Act also compelled the companies to give three months' notice to the local authorities of their intention to change from caunel to common gas, or *vice versâ*. In fact, to show the feeling of the companies upon this and other controversial points, a deputation met the authorities; and, in order to stave off another costly parliamentary inquiry, and to give a trial to the new Act, the companies agreed that they would not charge more than 4s. 6d. for coal gas for five years, they would not charge rent for meters for the same period, and that no cannel gas should be used except by special arrangement between the parties. The companies also undertook to make special arrangements for testing in such places as might be desirable, and lay a main to the Testing Officer's house, to enable him to test the gas without notice. In spite of this latter arrangement, "allegations" were made that "the companies would be able to change the gas before the testing could be effected."

Previous to the above date, it had, in December, 1860, been thought desirable to have the opinion of the Court of Queen's Bench upon the question of increase of price under the new Act; and the opinions of the Recorder of London, Mr. Russell Gurney, Mr. Bovill, and Mr. Gibbons was taken. The Great Central Company took the opinion of Sir Fitzroy Kelly, Mr. J. Horatio Lloyd, and Mr. Gibbons. The first three eminent Counsel gave it as their opinion that the question of price would not affect the old companies till Feb. 1, 1862, unless either of them should in the meanwhile elect to adopt the Act, in which case the provisions would apply. They were of opinion that the old companies could not alter their districts before the expiration of the three years; and that the Great Central Company would be compellable to furnish gas to any consumer, though by the Act of 1851 it was not compulsory. Sir Fitzroy Kelly, Mr. Lloyd, and Mr. Gibbons held that the Great Central Company, having elected to adopt the Act from Sept. 24, 1860, had a right to charge 4s. 6d. per 1000 cubic feet for gas supplied.

Though much that has been written deals with the Metropolis, it must be borne in mind that London had been the fighting ground of the gas industry during the last fifty years. The industry was practically born in London; and the battles fought for and against the London Gas Companies, the agitations, competition, &c., coloured the legislation with respect to the industry as a whole. In 1861, the price of gas south of the Thames was 4s. 3d., with a minimum charge (similar to the water companies) of 30s. per year, whether the gas was used or not.

In July and November, 1861, Mr. William Haywood made two very interesting reports on the "Carburation of Gas, as Supplied to the Public Gas-Lamps, by the Process of the United Kingdom Carburating Gas Company." This was a patent for placing near to the gas-burners a receptacle containing coal naphtha, the gas passing through or over this, taking up, and becoming enriched, by the additions of the volatile hydrocarbons contained in the naphtha; the illuminating power of the gas being increased from 25 to 77 per cent., according to the quality of the naphtha. The inventors claimed that equal light would be given with half the quantity of gas. It was stated that the naphthalization of gas would effect a saving on each public lamp of £1 per annum.

In December, 1862, the companies not agreeing, Mr. Haywood, in conjunction with Dr. Letheby and Mr. George Hughes, a well-known gas engineer, suggested fixing meters to public lamps and charging for the amount of gas consumed; and Mr. Hughes estimated that 30 per cent. less gas was given than was paid for. He calculated that so much less gas appeared to be furnished by the companies supplying Westminster, that over £2021 was being paid annually above the proper amount.* It was instanced that gas was allowed to be supplied by meter to the public lamps at Leeds, Leicester, Lincoln, St. Ives, Worthing, Torquay, and other places; and that it was universal in Scotland. The same year another lengthy pamphlet on the carburating or naphthalizing of gas to the public lamps was published.

It is interesting to note the names of the 22 companies in, and grouped around, London at this time: The Gaslight and Coke Company; City of London Company; Commercial Company; Equitable Company; Great Central Consumers' Company; Independent Company; London Company; Phœnix Company; Ratcliffe Company; Surrey Consumers' Company; South Metropolitan Company; Western Gaslight Company; Imperial Company; Crystal Palace Company (now the South Suburban Company); Woolwich, Plumstead, and Charlton Consumers' Company; Woolwich Equitable Company; Wandsworth and Putney Company; Brentford Company; Victoria Docks Company; Eltham Company, Limited; West Ham Company; and the Mitcham, Merton, and Tooting Company. The first 13 only of the foregoing companies were entitled to be called "Metropolitan Gas Companies," with powers to "district."

In July, 1864, a closely printed and scientifically interesting pamphlet, filled with tables, dated from No. 42, Parliament Street, signed by Thomas Greaves Barlow (the first Publisher of the "JOURNAL," then issued quarterly), addressed to the Directors of the Chartered, City of London, and Great Central Companies, dealt exhaustively with the "Sulphur Compounds Present in the Companies' Gas," and, for the purposes of experiment, in the Newcastle-upon-Tyne and Nottingham gas. At the latter place the writer was assisted by Mr. Thomas Hawksley. The treatise also dealt with the practice of the Paris Gas Company in reducing sulphur by raising the temperature of the retorts high enough to effect the distillation in four hours, and suggested that the London Companies should try the experiment at one of their works. Mr. Barlow also mentioned the process patented by Rev. W. R. Bowditch, of Wakefield, of passing the gas over lime heated to 450° Fahr., or the melting point of tin. This same reverend gentleman gave evidence before the Committee of the House of Lords on the Birmingham and Staffordshire Gas Bill, and stated that the method was in operation at the Worsborough Dale Gas-Works, near Barnsley. In the pamphlet Mr. Barlow describes the whole system, having visited the Worsborough works. A still more lengthy treatise accompanied this pamphlet, dated Paris, June 4, 1864, and signed by Albert Ellissen. This pamphlet also runs into many pages; is full of tables on sulphur compounds; is addressed to the same Directors; and is a translation from the French. Mr. Ellissen was associated with Mr. Barlow in his investigations for the London Gas Companies.

In the same year, Dr. Letheby gave his opinion on the reports of Messrs. Barlow and Ellissen, condensing and tabulating them; mention being made of the experiments of Mr. Bowditch, Dr. Angus Smith, and Mr. Hawksley's communication to the "JOURNAL."

Writing on the illuminating power and chemical quality of the London gas, Dr. Letheby in March, 1866, estimated a drop in the candle power as shown by the following table:—

Quality of the Great Central Company's Gas from 1853 to 1866.

	Illuminating Power in Standard Sperm Candles.		
	As Estimated by the Old Burner, 0·57 Inch.	As Estimated by the New Burner, 0·44 Inch.	
1853	13·99	15·65	
1854	13·13	14·69	
1855	13·28	14·85	
1856	13·34	14·92	Average of eight years before Metropolis Gas Act, 14·79.
1857	13·31	14·89	
1858	12·91	14·44	
1859	12·94	14·47	
1860	12·87	14·39	
1861	12·73	13·12	
1862	18·84	13·25	
1863	11 91	14·44	Average of six years since Metropolis Gas Act, 13·63.
1864	11·59	13·74	
1865	12·29	13·42	
1866	12·67	13·83	

He also alluded to the "excessively large amount of sulphur always present in the gas." This was followed by many complaints on the same subject during the summer and autumn of 1866. Truly, the lot of the companies then was not a happy one. In March, 1867, a pamphlet issued by Dr. Letheby, on the illuminating power of the Metropolitan gas, made the first mention of the late Mr. William Sugg—viz., "The burners having been the 15-hole steatite argand of Mr. Sugg, which, with a consumption of 5 feet of gas per hour, and with a 7-inch chimney, gives about 11 per cent. more light than the old brass burner."

On Nov. 5, 1867, a lengthy report signed by Sir John Thwaites and ten members of the Metropolitan Board of Works was issued by the Special Committee of the whole Board, on the supply of gas to the Metropolis. This report dealt with the steps taken by the Board during the session of 1866 with reference to a new Metropolis Gas Bill, and with the endeavours of the Board of Trade, and themselves, with regard to Sir Stafford Northcote's Bill, which was eventually dropped in favour of a City Bill later on. It is interesting to note in this report the suggestion again put forth, that the Metropolis should supply itself with gas in opposition to the companies—the suggestion being that the proper remedy would be for Parliament to concede to the authorities the power of supplying gas in the manner in which the Corporation of Manchester supplied that city. Valuable professional evidence was produced in support of the Board's propositions; the most important, perhaps, being that of Mr. C. G. Cleminshaw, a consulting engineer, who for fourteen years was manager of the city gas-works at Manchester. He expressed the opinion, founded on his experience as manager of those works, that under proper arrangements gas of 18 candles could be supplied in London at 3s. 6d., and the companies still pay 10 per cent., as both in Manchester and Liverpool gas of 22-candle power averaged 3s. per 1000 cubic feet. Among other witnesses examined were Mr. Hughes and Mr. G. W. Stevenson (whose services were requisitioned by the authorities in the preparation of the scheme for an independent supply), and Dr. E. Frankland—all confirming Mr. Cleminshaw's evidence.

A voluminous pamphlet was issued, in February, 1865, with an appendix "Giving Extracts from the Deed of Covenant between the Great Central Company and the Lighting Authority, dated 1850," stating that the consumers had for a long time been suffering from an insufficient supply of gas, and in October, 1864,

* This was borne out also by Mr. Arntz, the Surveyor to the Local Board of Westminster, who made an investigation, in the year 1858, into the quantity of gas supplied by the three companies lighting that district.

decided to obtain, at an expense not exceeding fifty guineas, the opinion of Mr. Hawksley as to the best mode of reducing the amount of sulphur in gas, and in January, 1865, the City considered the question of manufacturing its own gas. Mention is made of the report on the London Companies' gas of Mr. T. G. Barlow (who indicated a mode by which the sulphur could be considerably reduced), and also of Mr. Hawksley (who was associated with Mr. Barlow upon this highly important point), as probably the first gas engineer in England. It is, at this date, mentioned that London gas scarcely ever contained 20 grains of sulphur to the 100 feet before 1861; but since the passing of the 1860 Act it had rarely happened that the quantity had not been exceeded.

It is worth noting at this juncture, that the chemical purity of the gas supplied to many towns in the United Kingdom was much greater than was required by the Metropolis Act of 1860. At Birmingham, for example, the gas supplied by the Birmingham and Staffordshire Gas Company never contained a trace of ammonia or sulphuretted hydrogen, the proportion of sulphur rarely more than 17 grains per 100 feet. At Ely it was 7 grains; at Chatham, 18·2; at Oxford, less than 7·5; at Newcastle-on-Tyne, 4·9; at Nottingham, from 10 to 17; at Derby, 17·8; at Hanley (Staffs.), 14·4; at Winchester, 10·9; at Dublin, 17·9; at Hastings, 15·9; at Exeter, 3·6. In one instance only of all gas supplies of the United Kingdom, was 20 grains of sulphur found

In 1866, a Parliamentary Committee was appointed, under Sir John Trollope, to report on the 1860 Act, and the City of London Gas Bill, by which power was sought to establish a competing supply of gas. They recommended that the illuminating power should be increased and the maximum price reduced, and the power to make up back-dividends should be limited to three years instead of six, also "that the system of districts should be continued with a view to the economy of administration and the convenience of consumers and the public, and that every facility should be afforded by Parliament for the further extension of the system of regulated monopoly, either in the way of amalgamation of the several existing companies of the Metropolis, or of the disposal of the interests of them to some body or bodies representing the ratepayers, on such terms and conditions as may be agreed upon, and as Parliament may see fit to impose."

After this came Mr. Cardwell's Committee, to consider the Bill brought in by the Board of Trade, as an amendment to the Metropolis Gas Act 1860, in consequence of the report of Sir John Trollope's Committee of 1866. This Bill contemplated fixing a maximum price of 3s. 6d. for 14-candle gas, and limiting the dividend to 7 per cent. where that price was charged, with a sliding-scale for increasing the dividends when the price was below the maximum fixed. This might be termed a "one-way" sliding-scale. When, however, the Bill came before Committee, the companies offered 4s. as a maximum price, with an illuminating power of 14 candles. This was an improvement upon the 4s. 6d. and 12 candles of the 1860 Act; but as no company at this time was charging more than 4s., it was not much of a concession to the consumers. In fact, the South Metropolitan and the Imperial Companies were only charging 3s. 4d. The Board of Trade then made a suggestion of a maximum price of 3s. 9d. and 16 candles, and an amalgamation scheme with periodical remissions of price. The Metropolitan Board of Works urged that the Board of Trade's terms should be adopted for three years only, after which time the price should fall to 3s. 6d., subject to arbitration, in case it should be alleged by the companies that the cost of coal, wages, &c., had increased in the interval. The companies not agreeing to the propositions of the Board of Trade, the proposals came to nought. The general conclusions at which the Committee arrived were "that the Act of 1860 and the arrangements which it sanctions have been eminently favourable to the companies; while the interests of the consumer had been inadequately protected." Special attention is drawn to the fact that this important Committee came to the opinion that the companies were only entitled to the 10 per cent. dividend after the exercise of due care and management.

(*To be continued.*)

Retirement of Professor Lunge.—We learn from "Nature" that Professor G. Lunge has relinquished, at the age of 68, the Chair of Technical Chemistry at Zurich—a position he has held for the past 31 years. Professor Lunge's name is intimately associated, as our readers are aware, with the development of chemical industry in Germany, not only on account of the influence he exerted on his many students, but more directly owing to his inventions and treatises on applied chemistry. At the time when he, a young man, completed his studies at Heidelberg, chemical industry had hardly come into existence in Germany; so that, in order to gain practical experience, he found it necessary to proceed to England. In this country, in which he spent the twelve years from 1864 to 1876, he was first actively engaged in studying the problems connected with the distillation of coal tar, but subsequently became Manager of a large soda works at Tyneside. He was one of the founders of the Newcastle Chemical Society—a precursor of the Society of Chemical Industry. In 1876 he received a call to the professorship of Technical Chemistry at Zurich. His works on "Coal Tar and Ammonia" and on "Sulphuric Acid and Alkali" have, since the publication of the first volume in 1879, come to be regarded as almost classics in chemical technology.

OBITUARY.

SIR WILLIAM PERKIN.

We regret to record the death last Sunday night, at his residence at Harrow, from double pneumonia, after only four days' illness, of Sir William Henry Perkin, the founder of the coal-tar colour industry. Our readers will remember that within a few days of a year ago an international celebration of the fiftieth anniversary of the discovery of the dye-stuff "mauve" took place in London, in connection with which the honour of knighthood was conferred upon Dr. Perkin, who was presented with his portrait in oils; it being also decided to place a marble bust of him in the rooms of the Chemical Society, and establish a Perkin Research Fund. On the occasion of the presentation, Sir William also received the Hofmann Medal from the Deutsche Chemische Gesellschaft, the Lavoisier Medal from the Société Chimique de Paris, and addresses or other marks of recognition from various societies in Europe and America. The proceedings at the presentation were reported in our columns at the time, and it will probably be recalled that Sir William then related the story of his discovery, how, when a boy of fourteen, he wrote to Faraday and received permission to attend his lectures on electricity at the Royal Institution; and how, four years later, the great scientist himself went to the Chemical Society to hear this promising youth give a lecture on "Colouring Matter Derived from Coal Tar," and encouraged him by a few kindly remarks. Sir William was entertained at a complimentary dinner at the Hôtel Métropole on the evening of the presentation, when testimony to the great services which he had rendered to the world was borne by Mr. Haldane, Sir Henry Roscoe, Dr. Haller, and many others. Other honours which fell to him last year were degrees from the Technical High School of Munich and the University of Leeds. Last autumn he went to New York, where he was entertained by American chemists and manufacturers, was received by President Roosevelt, and afterwards had a degree from the Johns Hopkins University conferred upon him. Only last month he received the honorary degree of D.C.L. at Oxford.

It is unnecessary, in view of the account of the life-work of Sir William Perkin which has already appeared in our columns, to repeat the story. It is sufficient to say, in recording the sudden close of a remarkable career, that he was born in March, 1838, was the youngest son of Mr. G. F. Perkin, and received his early education at the City of London School, on leaving which, in his fifteenth year, he entered the Royal College of Chemistry in Oxford Street. He was a prominent member of many scientific societies. He was a Fellow of the Royal Society, and received a Royal medal in recognition of his work on the dye industry; was Secretary of the Chemical Society in 1869 and President in 1883; was awarded the Longstaffe Medal in 1889; and was the recipient of the Albert Medal of the Society of Arts in 1890. He was twice married, and leaves a widow. One of his sons is Dr. William Henry Perkin, Professor of Organic Chemistry in Owens College, and author of many works on chemistry.

SOCIÉTÉ TECHNIQUE DU GAZ PRIZES.

The Annual Meeting of the Société Technique de l'Industrie du Gaz en France finished on the 15th ult., and on the 8th inst. notices were sent to members announcing various international and other competitions and awards for next year's congress.

The prizes offered in the different classes this year are more or less the same as in former years; and any would-be competitor will get full information on applying to the Secretary of the Society, at No. 105, Rue Saint-Lazare, Paris. It is not necessary, therefore, to go into much detail here; but we must draw attention to two special competitions for the meeting of 1908. In Class A, relating to gas apparatus, particular attention will be given to small gas-engines for domestic purposes. This comes under heading No. IV. of the competitions, "For notable progress made in gas apparatus for domestic uses," and for which a prize of 5000 frs. (£200) may be awarded. In Class B, relating to essays and papers, there is, as previously mentioned in the "Journal," to be a special subject for competition—viz., "The Utilization of Ammoniacal Liquor in Medium and Small Works: Various Processes and Apparatus." Any person of any nationality may compete in these two classes; but the essay must be written in French, and be sent in before March 1, 1908. At the head of the MS. must be put a motto for identification purposes, as the author's name must not appear. This must be written in an envelope bearing outside the motto adopted, and the writer must make a declaration that his essay has not been published, and that he will not publish anything on the same subject within one year. The prize may amount to 8000 frs., or £320.

In addition to these two special competitions, there are the usual ones for progress made in gas apparatus coming under the following categories: (1) Apparatus for the manufacture or utilization of gas; (2) incandescent gas-burners; (3) automatic lighting at a distance; (4) gas apparatus for domestic purposes; (5) coke apparatus for domestic purposes; (6) poor-gas or water-gas producers. It may be hoped that some English manufacturers or engineers will consider the advisability of competing in some one or other of these classes.

REMOVAL OF NAPHTHALENE BY WASHING.

Herr Pannertz, the Municipal Chemist at Krefeld, recently described, in the "Journal für Gasbeleuchtung," an investigation he has carried out into the process for removing naphthalene from coal gas by treatment in a washer charged with anthracene oil. The research was instituted with the object of ascertaining why the gas supplied to a certain German town often contained 4 or 6 grammes of naphthalene per 100 cubic metres (1 gramme per cubic metre is equal to 0·437 grain per cubic foot), even when it was passed through two washers arranged in series, the latter of which was fed with fresh oil so frequently that the liquid only contained 4 to 5 per cent. of naphthalene.

The anthracene oil used for the experiments had a specific gravity of from 1·1132 to 1·1170 at 15° C., yielded from 6 to 6·5 per cent. by volume below 200° C. and 3·7 to 6·1 per cent. between 200° and 270° C. on distillation, and gave a permanently fluid distillate between the higher temperatures mentioned. It therefore only contained traces of naphthalene. When necessary, it was dried and filtered before being used in the following investigations. The gas was first passed through a 5 per cent. aqueous solution of oxalic acid, and next through two cylinders charged with a saturated aqueous solution of picric acid, in order to remove ammonia and naphthalene respectively; and it was then led through the anthracene oil at the rate of 30 to 36 litres per hour, at a temperature ranging between 17 and 19° C. After passing through the washer, the gas was led through an oxalic acid solution and two vessels containing picric acid, as before; the amount of naphthalene taken up by it being ascertained by titrating the picric acid.

The first experiments consisted in passing gas freed from naphthaleme in the above described manner through anthracene oil containing increasing proportions of naphthalenc. As the amount of naphthalene present in the oil rose from 1 to 30 per cent., so the proportion of naphthalene taken up by the gas rose regularly from 0·5 to 22·3 grammes per 100 cubic metres; and when the tests were repeated with air instead of gas, the results were similar, though rather lower. The gas loaded with naphthalene in the first experiments was next passed through some of the pure (naphthalene-free) anthracene oil. When the gas had been charged by passing through oils containing, 5, 10, 20, and 30 per cent. of naphthalene, subsequent treatment with the pure oil removed all but 0·4, 0·4, 0·5, and 0·9 gramme of naphthalene per 100 cubic metres respectively—*i.e.*, some, but not much, naphthalene was left unextracted.

A third set of experiments was tried in which the gas was charged with naphthalene by passing it through oil containing 10, 20, and 30 per cent. of the hydrocarbon, then washed in oil containing 2 per cent. thereof. The final gas contained 3·0, 2·1, and 2·2 grammes of naphthalene per 100 cubic metres. When gas similarly charged was led through anthracene oil containing 5 per cent. of naphthalene, it was found to retain 3·8, 4·1, and 5·8 grammes of naphthalene per 100 cubic metres respectively; and when the washing oil had no naphthalene in it, the final gas contained 0·9 gramme. It thus appears that an anthracene oil containing more or less naphthalene gives up to a gas free from that hydrocarbon more or less naphthalene in proportion to the quantity in the said oil; a kind of equilibrium being established between the two.

In further experiments, some anthracene oil withdrawn from a regular naphthalene washer and partially saturated with naphthalene was employed to wash a gas free from naphthalene and freed from ammonia by the process already quoted. A sample from the second chamber of the apparatus, having a specific gravity of 1·0992 at 15° C., and containing 9·1 per cent. of naphthalene, yielded up 4 grammes of naphthalene to every 100 cubic metres of the passing gas; while an oil from the first chamber of the washer, having a specific gravity of 1·0790 at 15° C., and containing 25·2 per cent. of naphthalene, gave a gas containing 11·4 grammes of naphthalene per 100 cubic metres. When the last-mentioned gas, with its 11·4 grammes of naphthalene, was led through anthracene oil free from naphthalene, the hydrocarbon remaining in the gas was only 0·5 gramme per 100 cubic metres.

Some gas treated as above to remove all naphthalene and ammonia was led slowly, at 17° C., through two towers, 20 centimetres (8 inches) high, loosely filled with pure sublimed naphthalene. The gas was found to have taken up 24·8 grammes of naphthalene per 100 cubic metres; and when afterwards it was led through pure anthracene oil, only 0·4 gramme was left in it.

The foregoing experiments show that if gas is to be satisfactorily freed from naphthalene on a large scale by washing it with anthracene oil, care must be taken that the oil in the final compartment of the washer does not become loaded with too much naphthalene. It is also desirable that the washer should be divided into three or four compartments, rather than the two commonly employed. The usual plan of keeping naphthalene and cyanogen washers distinct is to be recommended. Most important of all is to see that the bulk of the naphthalene is removed from the crude gas by thorough cooling and extraction of the tar, so that when it arrives in the proper naphthalene washer that apparatus may not be asked to perform more work than is reasonable.

PORTABLE INCANDESCENT LAMPS.

The recent strike of electrical machinists at the generating-stations in Paris, and the enforced adoption of lamps, showed that there was a field of utility for lamps in case of interruption in the regular sources of the supply of light. So much so that it may be questioned whether, in addition to gas and electricity, there is not frequently occasion for isolated installations of illumination, consisting of portable lamps of high power, by which light can be simply and cheaply produced. At least, so thinks M. Louis Denayrouze, who has given expression to his views in a paper read before the Société des Ingénieurs Civils of France, and a summary of which appeared in their May "Bulletin."

The first attempts, he says, at incandescent lamps using alcohol and petrol have given interesting results, without, however, their having been generally adopted. For this reason, further consideration has been devoted to them, their construction very carefully gone into, every mechanical complication being done away with, and the slightest trouble with heating the incandescent mantle being obviated. A lamp is described taking the form of a simple tube with an extremely thin partition, perforated with very fine holes, set to the 100th part of a millimetre. Its other parts were so designed that the thermic effect of the whole apparatus was absolutely invariable; the result being that decompositions of carburetted vapour producing a solid deposit were avoided, and there was not the least break in the evenness of temperature, which was generally the fault in the old carburetting lamps. It is stated that by these precautions an extremely adaptable light can be produced, ranging from a small lamp giving the equivalent of an electric incandescent lamp of 10 candles, to an arc light of 1000 candles. Thus, lamps which formerly seemed to be limited to country places may now have their uses for town purposes as well. In a report to the Prefect of the Department of the Seine, the isolated and the central methods of obtaining light are contrasted. It is admitted in it that the former system means a return to the primitive methods of the candle, with the difference that now the lighting power can be increased ten or a hundred fold, if desired. As the incandescent gas-mantle has been adopted with success in one only of the operations of light production, so may not recent progress in incandescent lamps be such that the entire production of light in the house may prove to be really simple and economical? Tests have been made with regard to (1) simplicity; (2) carburants; and (3) to obtain the "carcel" lighting power at a very low price. Compared with gas, it is stated that the cost per carcel-hour is never greater with incandescent lamps; and in comparison with electricity it is much less. The simpler and surer the working of these lamps is, the more will it be possible to use less purified and less expensive carburants. A lamp has even been designed which burned tar oil with very satisfactory results. In conclusion, M. Denayrouze thinks that portable incandescent lamps deserve close attention, especially at the hands of public lighting authorities.

The President of the Société des Ingénieurs Civils (M. E. Cornuault), who, it will be remembered, is a well-known gas engineer, at once combated the views expressed by the author of the paper. M. Cornuault said he himself was of a diametrically opposite opinion. Modern civilization necessitated distributing systems, whether for lighting, power, heating, water, or drainage. M. Denayrouze would lead us back to the primitive systems of illumination. Modern methods required concentration first and distribution second. To deny this would be to deny progress. Concentration in large works led to a low manufacturing cost, which was the essential factor in a low selling price. By high-pressure distribution over ever-extending mains, the minimum of expense should be added to the manufacturing cost, so as to have the lowest cost possible at the burner. Besides cost, simplicity, convenience, and appearance were sought after, and paid for like other things. Additional advantages of the distributing system were the low cost of maintenance, the absence of lamp reservoirs which required filling, and ease in lighting up. Other details might be gone into; but enough was said to show that the ideas enunciated by M. Denayrouze were effectively exposed and answered.

Tests of Reinforced Concrete.—We learn from the "Builder" that some official tests of exceptional importance were concluded on the 27th ult. by the British Fire Prevention Committee at their Regent's Park Testing-Station. They comprised load-tests with hollow reinforced concrete floor sections of a type that was first tested for fire resistance and obtained the highest classification of affording "full protection," and was then submitted for examination as to carrying power. One of these sections had the unusual span of 28 feet. Of the 14-feet floor spans tested, one could not be broken until it had carried an extraordinary load of more than 12 cwt. per foot super. Another 14 feet span broke on being loaded to the extent of about 6 cwt. per foot, after having been loaded and unloaded three times for elasticity, at loads varying from 4 cwt. to 5 cwt. The floor of the 28 feet span at a load of 6 cwt. per foot was not deflected more than 1½ inches. These results are considered important by the Executive of the Fire Prevention Committee in connection with the application of reinforced concrete now so well known in building construction generally.

THE ASSOCIATION OF WATER ENGINEERS.

ANNUAL MEETING AT WINDSOR—JUNE, 1907.

PAPERS READ.

(1)

HIGH-PRESSURE CENTRIFUGAL PUMPS.

Mr. R. C. J. Dicken, M.I.Mech.E., read a paper on the above subject, from which the following are extracts.

The first record of a multiple-disc centrifugal pressure-pump appears to be contained in an interesting patent taken out by Mr. John Gwynne, of Landsdowne Lodge, Notting Hill, on the 31st of March, 1851—the year of the Great Exhibition in London. The Mr. Gwynne referred to was the father of the present Managing-Director of Gwynnes Limited. A portion of the patent refers to "a centrifugal apparatus for raising fluids from great depths or to great heights, as in mining operations, also for obtaining a powerful blast or exhausting power for pumping air or gases, or for any other purposes where considerable pressure is to be obtained with a low rate of revolution of the impeller shaft." The patent included a method of counteracting the end-thrust on the shaft, various shapes of impeller blades, the use of a stop or guard to direct the discharge of the fluid, and a screw apparatus for regulating the discharge from the impeller. There were thirty claims in all, including a large variety of special apparatus for various purposes for which centrifugal appliances may be used. This patent covered nearly all the essential features of the high-pressure centrifugal pumps made at the present day.

A period of about 45 years, however, elapsed before this type of pressure pump was manufactured on a commercial scale. In the meantime, centrifugal pumps of the ordinary type were arranged in series on one shaft, with the discharge of each pump connected by a U-pipe to the suction of the next. As many stages were used in series as were required to produce the necessary pressure to overcome the head against which the pump had to work. Messrs. Gwynne were making this form of series pump in 1895.

Early in the year 1903, Messrs. Parsons obtained an order from the Department of Public Works of New South Wales to provide pumping machinery for supplementing the supply of water to Sydney. This plant was to bring water from the Nepean River, some fourteen miles away, necessitating a lift of 240 feet, including friction head, and was illustrated and described in a paper read by Mr. F. G. Holden before this Association at Scarborough last year.* The type of pump above described is not that which is now found to be the most efficient for high pressures, but the plant is of interest as an example of a water-works pump driven direct from a steam turbine.

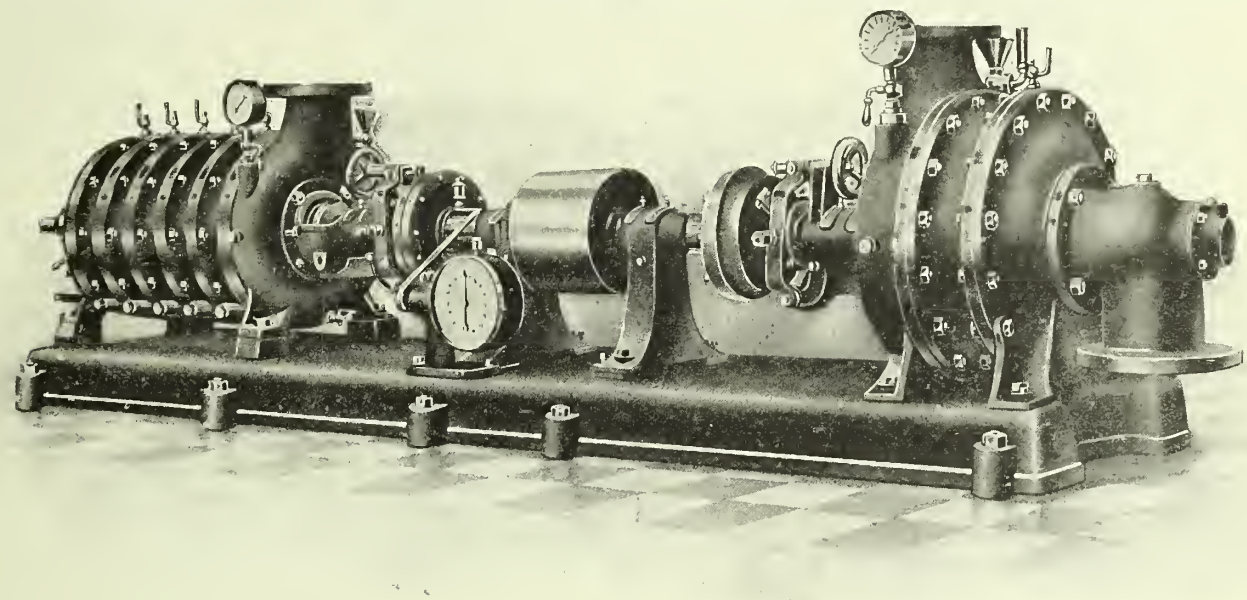


Fig. 1.—Worthington Pumps at Portsmouth.

In or about the year 1896, Messrs. Sulzer Bros., of Winterthur, gave their attention to the design of high-lift centrifugal pumps; and the credit of introducing the present type of pressure pump is to a large extent due to them. The water enters the pump and is delivered by the first impeller through guide passages into an annular chamber leading the fluid to the inlet side of the second impeller, which delivers it through guide-blades and another annular chamber to the next pair of impellers, which are arranged in a similar manner. Each pair of these single-inlet impellers is arranged back to back, in order to neutralize end-thrust as far as possible. The guide passages divert the water from the tangential direction given by the impeller to a flow nearly radial, and prevent excessive swirling in a circular direction. The high velocity of the water as it leaves the periphery of the impeller is reduced by the gradually increased openings, and assists in converting part of the velocity into pressure. By the first impeller, the fluid is brought to a pressure or lift corresponding to the number of revolutions or periphery velocity. It then passes to the second impeller, which gives the double pressure. From the second it passes in the same manner to other impellers, each of which adds its unit of pressure. The total lift is therefore equal to the pressure developed by one impeller multiplied by the number of impellers.

Messrs. Gwynne commenced very early to manufacture high-pressure pumps, and they have specially devoted their attention to avoiding end-thrust, which is the great defect of all pumps of the single-inlet type. They have also made many pumps of the single-inlet type; but in every case they found it necessary to provide large ball-bearings to take the end-thrust. One of these pumps, made for the Brancepeth Colliery, Durham, in 1906, was required to deliver 500 gallons of water per minute against a head of 486 feet. The pump was driven direct from an electric motor capable of giving 116 B.H.P. at 1040 revolutions. It has twelve impellers of the single-inlet type, and the end-thrust is taken by a large Hoffmann ball-thrust bearing on an extension of the pump-shaft.

In 1906, Messrs. John Gwynne and E. W. Sargeant patented a new design of pressure pump, the suction inlet of which opens into a divided chamber which conducts the fluid to both sides of the impeller. The discharge from the periphery passes through guide passages, where it is deflected and reduced in velocity. Passages conduct a portion of the water to the further side of the next impeller in a similar manner. By this arrangement the admission of the fluid to both sides of the impellers makes it unnecessary to provide special end-thrust bearings, balancing pistons, or other contrivances to take up the end-thrust.

* See "Journal," Vol. XCV., p. 445.

A pressure pump which is being manufactured by Messrs. Hayward Tyler and Co., Limited, contains several special features. Each impeller is curved at the outlet, so as to discharge the fluid in the required direction into a suitable passage in the stationary guide-wheel leading to the next impeller. This passage is provided with guide-vanes. A ball-bearing to take the end-thrust is placed inside the casing of the main bearing. Another balancing device is also used in addition to the ball-bearing.

The Worthington Pump Company have erected several pumps for water-works service at the Philadelphia Pumping-Station near Durham, and also at the Watford and Portsmouth Water-Works. The Portsmouth pumps, shown in fig. 1, consist of two pumps of different capacities, belt-driven from a suitable oil-engine. Either or both pumps may be used by connecting or disconnecting the friction couplings provided at either end of the pulley shaft. Fig. 5 shows a sinking pump made by the Company for mine drainage.

Many methods have been proposed for balancing the end-thrust on single-inlet impellers, some selected examples of which the author described. The practice adopted by Messrs. Sulzer, of placing the discs in pairs back to back, has already been referred to. The balance ceases, however, to be correct if the conditions of lift are altered. Therefore a thrust bearing is necessary, in addition, to overcome any end-pressure left unbalanced. But in the simple method adopted by Gwynnes, of admitting the water to both sides of each impeller, as each impeller is self-balanced, it is not affected by the conditions of lift being altered.

Fig. 2.—Gwynne-Sargeant Charging Apparatus.

After offering some remarks on the design of impellers and water passages, the author passed on to the subject of charging centrifugal pumps. In steam-driven pumps, the simplest and most satisfactory method of charging is by the steam ejector. Where no steam is available, a foot-valve may be placed at the bottom of the suction-pipe, and the pump filled from the top by a pipe connection and cock from any convenient source of water supply, or by means of a funnel. A retaining and sluice valve should, however, be placed on the delivery-pipe of the pump, so that, in stopping, the shock of the whole column of water does not come on to the interior of the casing by the sudden closing of the foot-valve. A hydraulic ejector similar to the steam ejector, but differently proportioned at the nozzle, may be worked by water from a town main or any suitable supply of water under pressure. In the Gwynne-Sargeant charging apparatus which is shown in fig. 2, the pump and funnel are first filled with water, which is circulated by the pump through the hydraulic ejector on the downward part of the U-shaped delivery-pipe back to the funnel—the latter being placed on the vertical inlet of the pump. The pipe on the side of the ejector is connected to a cock on the top of each section of the pump to be charged. A vacuum of 29 inches can be obtained by these hydraulic ejectors. A small vacuum pump, driven either by hand or from any source of power, may be used to exhaust the air from the pump and suction-pipe, and so cause the water to rise and fill the pumps.

As to the methods of driving, the most perfect motive power for a centrifugal pump, so far as is known at present, is the electric motor, as both parts of this combination are of the rotary, or non-reciprocating type, and the speeds of each are conveniently adapted to each other. The continuous current motor has the advantage of being capable of varying speeds and powers, to suit varying lifts and discharges of pumps. The motor is usually coupled direct to the pump by a flexible coupling. Where motors of the constant-speed type are used, the discharge from the pump may be reduced by partially closing the sluice-valve on the delivery-pipe. This at the same time reduces the amount of current used. The power taken in starting a centrifugal pump increases in proportion to the acceleration of speed. Therefore it is exactly suited for a motor of the alternating type, which does not attain its power until full speed is reached. A typical arrangement of a horizontal spindle pump driven by a motor is shown in fig. 3. The most satisfactory arrangement of a steam-driven set, when the lift is not too high, is by the combination of a high-speed compound or triple-expansion reciprocating engine of the forced lubrication enclosed type directly coupled to the pump.

Fig. 4 shows a vertical spindle motor-driven sinking-pump. The whole of the machinery is attached to a frame, arranged to slide in guides fixed in the shaft to be drained, and provided with a large suspension pulley for raising and lowering by a wire rope. The space occupied is much smaller than that of a steam sinking pump of the same power, and the economy is considerably greater. This type of sinking pump has met with considerable favour, and in some instances has succeeded where steam-pumps have failed. It is frequently retained as a permanent drainage pump after the shaft is completed.

Dealing with the advantages of centrifugal pressure pumps, the author remarked that, though it is not claimed that this type of pump will equal high-class reciprocating water-works pumps in economy of steam and coal consumption, he thought the following points were worthy of consideration by engineers when new pumping machinery is required. The weight of machinery required for a given duty is only a fraction of that required by the ordinary reciprocating beam or other type of pumping engine. For instance, the weight of a beam pumping set delivering 1180 gallons per minute against a head of 505 feet is given from an example as 178 tons, whereas a high-speed compound surface condensing engine driving a centrifugal pressure pump by ropes should not weigh more than 28 tons at the outside. An electric motor driving direct a pressure pump for the same duty, complete with a suitable flexible coupling, would weigh about 12 tons, and would occupy a floor space of about 20 ft. by 6 ft. A horizontal compound jet condensing duplex pumping-engine delivering 900 gallons per minute against 150 feet head weighs about 10 tons. A pressure pump and electric motor for the same duty would weigh about 3½ tons, and occupy a floor space of about 9 ft. 6 in. by 4 ft. 6 in. These comparisons of weights are only approximate; but they will suffice to illustrate the fact that the weights, and therefore the initial cost, of centrifugal pumping machinery are far below those of the reciprocating types generally used, when the conditions are suitable for the former.

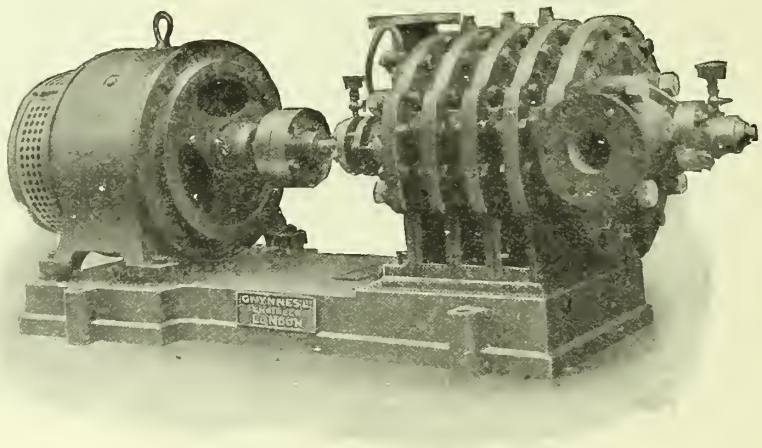


Fig. 3.—Motor-Driven Horizontal Pump.

Fig. 4.—Gwynne's Sinking Pump.

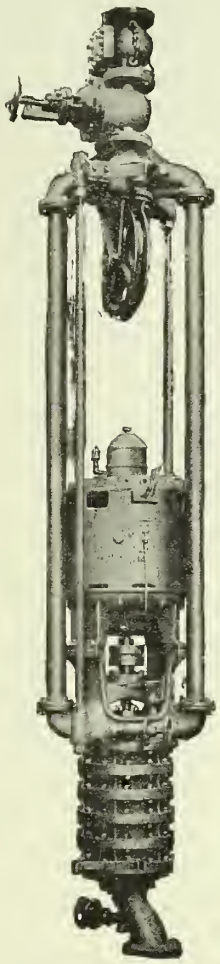


Fig. 5.—Worthington Sinking Pump.

In centrifugal pumps, the flow of water is absolutely steady and without shock, and air-vessels are unnecessary. There are no valves to get out of order, and grit or occasional small stones will go through without doing serious damage. The water, however, should be kept as free as possible from solid matter, so as to prolong the life of the pump. The delivery sluice-valves may be partially closed to vary the output, and may be closed entirely while the pumps are running, without causing damage, as the pumps are only capable of producing pressures corresponding to their speeds. The working parts are very few in number, consisting only of the impellers, spindle, and bearings; therefore the "spares" required are much reduced. The lubrication being practically automatic; very little attention is required when running. The advantage of a centrifugal pump, even in regard to initial cost, disappears when a small quantity of water is required to be lifted to a very great height. With regard to efficiency, the difference between water horse power and brake horse power varies with the size of pump and the conditions under which it is working. Efficiencies vary between 55 and 75 per cent., though in some cases the latter percentage appears to have been exceeded.

[The paper was illustrated by a number of diagrams and reproductions of photographs of pumps.]

Discussion.

Mr. R. Askwith (Weardale Water Company, Bishop Auckland) said he had had no experience in connection with centrifugal pumps; but a year ago, when considering the putting down of plant to pump water from a reservoir in which the water lowered and rose with the rainfall, he had to take into account the vertical height of the pump above the level of the water. He reluctantly had to give up the idea of putting in a centrifugal pump; and he decided to adopt a three-throw pump, because the makers of the centrifugal pumps would not guarantee that the pump would work satisfactorily if the water was more than 22 or 23 feet below the bed-plate of the pump. With a three-throw ordinary plunger pump, they could go as low as 28 feet below the bed-plate; and the pump would work efficiently at that. He had to discard the idea of using a centrifugal pump, because they wished to pump very frequently when the water was down more than 25 feet below the bed-plate of the pump.

Mr. H. Preston, F.G.S. (Grantham), said that perhaps he might offer a remark here which he had thought of making in connection with Mr. Cobban's paper. At the Scunthorpe works, that gentleman had two pumps—one a three-throw, and the other a high-pressure centrifugal pump, both of which were calculated to do the same amount of work. He (Mr. Preston) was there a few weeks previously; and saw both the pumps worked. They were driven electrically; and the power required to drive the three-throw pump was $4\frac{1}{2}$ amperes, while the power required to drive the centrifugal pump was 7 amperes, which was a very considerable difference, seeing they were each calculated to be doing the same amount of work—*i.e.*, each pumped the same quantity of water to the same height through the same main. Perhaps Mr. Cobban, or the author of the paper, would give the members some idea as to the reason for this difference. The members would like to know the efficiency of the high-pressure centrifugal pump in more definite terms than they had so far got it.

Mr. A. M. Cobban (Scunthorpe) remarked that Mr. Preston had said the centrifugal pump was not so efficient as the three-throw pump; the three-throw pump working at $4\frac{1}{2}$ amperes, and the high-speed centrifugal pump at 7 amperes. He (Mr. Cobban) might say that the pressure-gauge on the centrifugal pump indicated 260 feet head, and the pressure-gauge on the ram-pump only 180 feet—both delivering through the same rising-main. The increase in the load required and also in the head was due to the stand-pipe over which the centrifugal pumped into the rising-main.

Mr. William Matthews (Southampton) remarked that the last speaker got rather to the kernel of the whole thing with regard to these efficiencies; and he (Mr. Matthews) was not much surprised at what was said. He was glad to have an actual case of comparison between the two types of pumps; but even having regard to this comparison, he did not think that three-throw pumps represented the form of pump from which they might expect the highest efficiency. But it was certainly a remarkable result that, in the one case, there were 7 amperes of electrical energy used, while in the other there were only $4\frac{1}{2}$ amperes. But when they found the frictional resistance was 80 feet of water in one case, it explained the whole thing, with the enormous velocity at which centrifugal pumping must be done. One comparison in the paper which he thought was misleading was as to the advantage of centrifugal pumping with regard to the weight of the machinery required. He admitted that, if they took a beam pumping-engine for purposes of comparison, the weight would no doubt, as in the particular case mentioned in the paper, come out very much what was stated; and they might have 178 tons of metal in the beam engine, and only 28 tons in the centrifugal pumping machinery. But he submitted that the price per ton which would be paid for the 178 tons in a beam pumping-engine would bear no comparison whatever with the 28 tons paid for in the centrifugal pumping machinery. Take a beam engine, a great amount of the weight was in the entablature and beams, costing probably not more than from £12 to £15 per ton; while in centrifugal machinery no part would be worth less than from £20 to £25 per ton. In this respect, therefore, the author's comparison was not a very reasonable one.

Mr. Percy Griffith (London) said he thought it would be obvious, having regard to what Mr. Matthews had said, that the author had not suggested that this type of plant should be placed in direct competition with the ordinary type of pump under normal conditions. He (Mr. Griffith) had had a case where he hoped to have to put in a plant under special conditions in which the centrifugal pump offered very real advantages over the old type. One point was the time which would have been required to have an ordinary type of plant made, delivered, and erected. Ordinary plants of large capacity could not be kept in stock, and to make such a plant generally occupied a good many months. In the case referred to, it was an essential condition that the plant should be installed on very short notice, and he could not have got any other type of plant within the short time available. A similar question arose with regard to the fixing of the pump at a depth of 400 feet below the surface. It was very necessary to have a pump which could be lowered from the surface down the well, and which would work not only when suspended at this depth, but also while being lowered to suit the pumping level of the water.

Unfortunately, owing to circumstances over which neither he nor his clients had any control, he did not have the opportunity of carrying out the work. He might add that he had contemplated driving the pump electrically.

Mr. A. B. E. Blackburn (Sunderland) remarked that the pump the author had brought before the members' notice seemed to be one which was suitable for forcing water from the surface of the ground, or where there was a low lift; but he did not see the least advantage of it for deep wells. He should like the author to enlighten them as to the manner in which the pump could be used for pumping water from deep wells, or from any depth up to (say) 400 feet. Regarding the shafting, the author had told them the well pump was driven by shafting which was enclosed in tubes. He should like to know how this shafting was guided, and how lateral movement was prevented. Another vital point on which information was desirable was the way in which the power was communicated from the motor to the pump.

Mr. Dicken, replying to the discussion, said the first question asked by Mr. Askwith concerned the distance between the water and the bed-plate at which the centrifugal pump would work, and he thought the three-throw pump would lift to a greater height. This was quite possible. The limit at which the centrifugal pump could be placed above the top of the water depended on the height at which they could charge it in the first place. Of course, various methods of charging might be used. The steam-ejector would charge very well at 24 or 25 feet, measuring from the water-line to the top of the pump casing. When once the pumps were working, they would lift as high as any other pump. In fact, he had information that they had overcome a suction lift of quite 30 feet. But, of course, they had to start the pump; so that it was well not to place the top of the casing above the water (say) more than 24 feet for a small pump or 26 feet (as was frequently done) for a large pump. Mr. Preston, in his remarks, spoke of the comparison of a three-throw pump and a high-pressure pump, and said that at Scunthorpe the three-throw pump took 4½ amperes, and the centrifugal pump 7 amperes. It was explained later on that, in the case of the three-throw pump, the head against which it was working was 180 feet, and the head against which the centrifugal pump worked was 260 feet. Probably the same sized main was used for both, in which case, with the three-throw pump, the flow of water would be very slow through the main, and there would be little loss caused by friction. In the case of the high-pressure centrifugal pump, the velocity of the water might have been very high indeed; giving a corresponding increase in the quantity of water delivered, and in head put on in friction. But if one pump was working against 180 feet, and the other against 260 feet, the comparison was hardly fair.

Mr. Preston: It is the same main, the same reservoir, and the same head really so far as the main is concerned.

Mr. Dicken said that any increase of flow meant also head lost in friction, besides the larger quantity of water lifted; and this was no doubt the reason why the amperes in one case were much greater than in the other. He was not saying that in any case the centrifugal pump would be as efficient as the three-throw; but the difference, if any, would be very small. Mr. Matthews spoke of comparative costs in running, coal consumptions, and so on. In a paper like this, which dealt only with the centrifugal pump, it was very difficult to give these figures because they depended entirely upon the type of motive power used—whether a triple-expansion steam-engine, which was economical; a non-condensing engine, which was not economical; or a suction-gas plant, and so on. If the efficiency of the pump itself was known, it seemed to him that it was quite possible to take the efficiency, and, knowing what type of driving power was to be used, the fuel consumption could be worked out from that. He was sorry the paper did not give the various types of driving power and their coal consumptions; but the efficiency was given, which enabled one to arrive at the required information. Mr. Matthews said, comparing the weight per ton of the beam pumping-engine with the centrifugal pumping-engine, the cost per ton in the heavy engine would be less than in the smaller one. Of course, it was not claimed in his paper that this was not so. Still, even taking all these things into consideration, it would be found that the statement in the paper was approximately correct as to the relative weight; and it also remained true that the cost of the centrifugal plant would be only a fraction of what it would be for a beam pumping plant. He was much obliged to Mr. Griffith for speaking as he had done, and for fully explaining that there was no comparison between the cost per ton of the centrifugal pumps and that of other types of pumps. As Mr. Griffith had said, the suspended pump could be raised up and down. There was an illustration given in the paper of a sinking pump which enabled this to be done. These sinking pumps had been found very useful indeed; and very many had been made. Mr. Blackburn had inquired about the method of steadying the vertical shafting, where the pump was placed below the water-level and the motor above the well. Of course, he (Mr. Dicken) should have explained that it was not proposed to make this vertical shafting very long. He did not correctly remember the length of the one referred to; but probably it would not be more than 15 or 16 feet; and there would be two intermediate bearings in this length. As the shaft ran in a water-tight pipe or casing, it was easy to carry tubes down to these bearings to keep them lubricated. In conclusion, he desired to thank the members of the Association for the manner in which they had received and discussed his paper. He must apologize for not having done better justice to so important a subject.

(2.)

THE DETECTION OF POLLUTION IN UNDERGROUND WATERS.

Dr. John C. Thresh, the Medical Officer of Health to the Essex County Council, read a paper on "The Detection of Pollution in Underground Waters."

The author began by referring to the papers previously contributed to the "Transactions" of the Association—notably one by Mr. John Shaw and another by Mr. William Watts*—and said it was not his intention to go over the ground already covered, but rather to direct attention to certain methods of locating the sources of pollution which it was hoped would prove of interest to all connected with works of water supply, where the water was derived from underground sources. He then proceeded to point out that outbreaks of typhoid fever which have been attributed to polluted waters have practically all been cases in which matter of an excremental origin gained direct access to the source of supply or to the water on its way to the consumer. He said he was anxiously looking out for the record of any outbreak in which the contaminating matter had to percolate through several feet of compact soil before it reached the incriminating water, but had been unable to find one. As the result of a great deal of experience in connection with typhoid outbreaks, and a special study of sporadic cases, he had been driven to the conclusion that water, in slowly percolating through a few feet of compact soil, cannot carry with it the microbe which causes typhoid fever; and, consequently, that anything in solution may traverse the subsoil and reach the water therein without being able to communicate to it the typhoid bacillus. Water derived from a compact soil could therefore be readily rendered perfectly safe by proper construction of the collecting well and by adequate protection of a limited area around the source.

Dr. Thresh went on to point out that the fact of underground water becoming polluted is too often only discovered by a sudden outburst of typhoid fever. This, the author said, would probably never be the case were the water submitted to periodical examination, which should not be limited to a mere chemical analysis, as from a water supplier's point of view a bacteriological examination was the more important. If examinations were made systematically, the normal condition of the water was soon ascertained; and should at any time an abnormal condition be found, its cause could be sought for, and, when detected, it might admit of a remedy, which might possibly prevent outbreaks of disease that sooner or later would have ensued had not the defect been discovered and the remedy applied. Unfortunately, the cause of the contamination was often very difficult to find, and sometimes one had to admit an utter failure to discover it. But usually this was because the water authority would not go to the necessary expense, or could not obtain sanction from tenants or landlords, to carry out the experiments required. The systematic examinations above referred to often enabled the investigator to form some opinion with reference to the character of the polluting matter, and its proximity to the source of the water.

The author emphasized the point that before making

* Mr. Shaw's paper was noticed in the "Journal," Vol. LXXX., p. 1750, and that of Mr. Watts in Vol. LXXVIII., p. 211.

experiments with chemicals a careful survey of the whole position must be made; and he then proceeded as follows: To ascertain whether a given source of pollution can affect a given well, it is usual to introduce some chemical at the point of suspicion, and then examine the water at frequent intervals to ascertain whether the chemical selected can be detected in it. For this purpose, common salt (sodium chloride), a lithium salt, or a dye named fluorescein has been employed; and recently the author has used ammonium salts, since, in certain cases, they possess advantages over the others. Sodium chloride is used chiefly because it is very cheap, easily obtainable, quite innocuous, and easily detected and estimated in the water. As all waters contain chlorides, the normal chloride must be first ascertained, then any subsequent increase during the experiment may be attributed to the salt used. Slight variations are often observed in water from the same well. Consequently enough salt must be added to produce a more marked effect than any recorded in the normal water. The quantity must be at least equal to 1 grain of salt per gallon (= 0·6 gr. Cl.). Should it prove necessary to add this amount to a large quantity of water, the weight of salt used must be considerable. For example, it may be necessary to add sufficient salt to materially increase the chlorine content of 1,000,000 gallons of water. To do this would require 1,000,000 grains, or 143 lbs., of salt—an amount which can easily be handled and readily dissolved and passed into the soil. If, however, it is estimated that at least 100 million gallons of water will have to be affected, then 6 to 7 tons of salt must be used—an unwieldy quantity, difficult to deal with. Where anything like this volume of water has to be considered, a substitute for salt would now be used. [The author gave two examples of the use of salt for the detection of pollution.]

A salt of lithium has frequently been used instead of salt. Exceedingly minute quantities of this can be detected by means of the spectroscope. A crude lithium sulphate, which answers every purpose, can now be purchased at 4s. per lb. About 1 part of this salt in 1,000,000 of water may be detected (1 grain in 14 gallons); and inasmuch as lithium is not a normal constituent of potable waters, its detection after the use of the salt is positive proof of direct connection between the point where the lithium has been placed and the source of the water. Unfortunately, the detection of such minute traces in a considerable amount of deposit left by the evaporation of the water is very tedious and troublesome; and to use any quantity of the substance at 4s. per lb. is very expensive. For these reasons, lithium salts are now rarely employed.

The author has recently used ammonium chloride (sal ammoniac) in several investigations, with marked success. It is very cheap, free from colour, perfectly harmless, and the ammonia, even in great dilution, admits of easy detection and estimation. When 7 lbs., costing about 3s. 6d., are dissolved in 1,000,000 gallons of water, the ammonia can readily be detected. The amount of ammonia present in all good subsoil waters is too trifling to interfere. But certain very deep wells yield waters and many polluted waters contain very varying quantities of ammonia; hence in some of these cases the use of an ammonia salt might not lead to definite conclusions. It must also be remembered that the salt must be put directly into the subsoil water or fissure, as if spread on fertile ground a portion of it might be nitrified by the nitrifying organisms of the soil. Probably, however, in any case, the amount nitrified would be only an infinitesimal portion of the salt employed. On the whole, it may be regarded as much more convenient for use than either common salt or salts of lithium.

Another substance of an entirely different character, which is of special importance in such investigations as these, is a colouring matter called fluorescein. Many of the aniline dyes possess enormous colorific power; but most of them, when in very dilute solution, are decolorized by filtration through soil, and others are too expensive or are objectionable in other respects. Fluorescein appears to be unaffected by passage through chalk, sand, surface soil, &c.; and dissolved in water by the aid of an equal weight of caustic soda, it can be easily detected by its fluorescence when the dilution is 1 in 100 millions. Under very favourable conditions, 1 in 200 millions may be detected. In other words, 1 lb. of fluorescein will distinctly colour 10 million gallons of water. As the demand for this substance has increased, the price has gone down, until it can now be purchased at 7s. 6d. per lb. in quantities of 10 lbs.

The relative cost of these various substances used in sufficient quantity to affect one million gallons of water would be: Fluorescein 9d., common salt 2s., ammonium chloride 3s. 6d., and lithium sulphate 40s. Fluorescein is therefore much the cheapest, it is the easiest to apply, and by far the easiest to detect. There is only one possible objection to it, and that is that, if used incautiously, it may so colour the whole of a water supply as to cause alarm on the part of the consumers. For this reason, it is in most cases preferable to use salt or ammonium chloride in the first instance; and if, when used in moderate quantities, these give no definite results, to employ fluorescein. This dye has been largely used for tinting underground streams to trace their course, and to a certain extent for determining the direction and rate of flow of subsoil water; and one case is recorded where it unexpectedly made its appearance in a public water supply and caused considerable astonishment and some alarm. More recently it has been applied for the special purposes dealt with in this paper; and some recent experiments carried out on a somewhat large scale near Cambridge may be cited as examples.

In 1905, a series of cases of typhoid fever occurred at the County Asylum near Cambridge, and the Local Government Board instructed Dr. Monckton Copeman to investigate it, and more especially to report with reference to the risk of pollution of underground water supplies by the sewage of the asylum. A detailed description of the geology of the district is given in Dr. Copeman's report. The asylum sewage was disposed of by a crude system of broad irrigation on land which consists of a thin layer of loamy soil covering the chalk. The well supplying the asylum is about 60 feet deep and some 1200 feet to the west of the portion of the irrigation area selected for experiment, and about 2500 feet east from a well 70 feet deep which furnishes the chief supply to the city of Cambridge. A hole was dug to the chalk on the irrigation area, and 0·5 kilo. of fluorescein, dissolved by the aid of caustic soda, was washed into the chalk, and samples of water from pits and wells around afterwards collected for examination. The results not being conclusive, a further experiment was made, using 5 lbs. of fluorescein. The experiment was started at 11 a.m. on Oct. 18, and at 3 p.m. the colour appeared in a pit 200 feet N.N.E.; at 9 a.m. on the 20th, it was found in a pit 700 feet E.N.E.; and at 4.30 p.m. on the 21st, it was seen in a pit between the sewage plot and the pit in which it was observed the previous day. On Oct. 22, it was found in the water of the asylum well; and on Oct. 27 in the water of the Fulbourne well. It had therefore taken some 103 hours to travel about 1200 feet westward, and about 9 days to travel 2500 feet to the eastward. The wide diffusion is an interesting point, as the wells both to the east and west were affected. At no time previously had these waters come under suspicion, and neither bacteriological nor chemical analyses apparently had ever indicated contamination. Dr. Copeman therefore adds: "It does not, of course, necessarily follow, because the fluorescein should have proved capable of detection at various points, inclusive of the asylum well, at so great a distance in different directions, from the point at which it was introduced, that bacteria, harmful or otherwise, would be equally capable of transmission for so considerable a distance; but, nevertheless, the results of these experiments are decidedly instructive and important."

The Asylum Committee were advised to make some arrangement for dealing with their sewage which should remove all risk of the effluent contaminating either of the sources of water; and the author was requested to report upon the best method of securing this desirable result. A study of the geology of the district had led him to infer that beyond a certain line the underground water would be travelling in a direction away from the wells; and to prove this, a hole was bored on the site, and 2 lbs. of fluorescein, dissolved and suitably diluted, was poured into the bore. It quickly disappeared; but though all the pits, wells, springs, &c., around were watched, no trace of the colouring matter was ever seen again. A further experiment on a larger scale was therefore decided upon, and carried out in the following manner: Two boreholes, 30 feet deep, were made at opposite sides of the field selected. They were 110 yards apart, and both yielded water freely. A trench was cut from a point 6 yards north of the south bore to a point 6 yards south of the north bore. This trench was 96 yards long, 1 foot wide, and 6 inches deep. Water was pumped from the south bore at the rate of 25,000 gallons per day; but it filtered through the trench so rapidly that a pump had

to be placed in the north bore. When the second pump was started, the whole of the trench could be flooded, and also a shorter trench cut at right angles and communicating with it. Pumping was kept up for three days to thoroughly saturate the ground, before the fluorescein experiment was commenced on March 8. A tub was mounted at each end of the long trench; and in each was placed 1 lb. of the dye. While pumping was continued, the solution was allowed to dribble into the water as it entered the trench. The time occupied in running in the solution was, on an average, four hours. On the 8th, 4 lbs. were put in, 4 lbs. on the 9th, 2 lbs. on the 10th, and on the 12th 1 lb. was run direct into the north borehole.

The amount of dye used would have distinctly coloured 150 million gallons of water. Watch was kept at seventeen different points. At no time did any colour appear in the south borehole; but in the north one the water was tinted seven hours after the commencement of the experiment. No trace of colour appeared elsewhere until nine days later, when it showed in the water contained in a chalk pit 300 yards N.N.W.; on March 31, the colour was observed in a well water 1200 yards farther N.N.W.; and on April 7, it was detected in the marsh water near the River Cam, something like 3000 yards away, still in the same direction. At no other points has any trace of colour been detected. This second experiment, therefore, not only confirmed the first in so far as it showed that water from this locality did not travel towards either of the wells, but it also proved that the coloured water travelled in a definite direction, which, fortunately, is quite away from the sources of supply. The depth of colour observed has never been greater than that produced by 1 part of the dye in 130 million parts of water, save at the north borehole, where it was much more deeply tinted.

These examples must suffice, though many more could be quoted. When the results of experiments of this character are known, there still remains the more difficult task of interpreting them correctly. To do this may be as difficult as, or even more difficult than, the interpretation of chemical and bacteriological analyses. Where the colour or other substance used for the test appears quickly and in quantity in the water under suspicion, grave danger may be apprehended; but where it takes many days to appear, and is then only found in infinitesimal traces, there is possibly no danger. The necessity for frequent bacteriological observations is, however, emphasized; and probably the results of the two sets of operations would enable some perfectly correct interpretation to be made.

To do away with any doubt as to whether bacteria can be conveyed from any given point to a deep source of water, it has been suggested that certain easily recognized bacteria should be introduced into the soil at the point where pollution is suspected to arise, and to examine the water repeatedly for the special bacteria. Experiments of this kind have been recorded; and it has been shown that bacteria can be washed by very heavy rains through a few feet of soil into collecting trenches beneath, but they have never been traced any considerable distance. The author's experience with this test, using the *bacillus prodigiosus*, has not led him to regard it with any favour; nor would it justify him in recommending it, though one can conceive cases in which such a test would afford information of value.

Some time ago, the author commenced experiments in a brick channel about 36 feet long, 1 foot wide, and 3 feet deep. A little shingle was placed along the bottom, and the trench was filled up with fine sharp sand such as is used by builders. At intervals of a yard, glass tubes 2 inches in diameter were inserted 2 feet into the sand, and water was run in until its level was about 1 foot from the surface. Water was then allowed to flow away slowly from the bottom of the trench at the opposite end to that at which the water was being introduced, and a condition of equilibrium maintained. An emulsion of the *bacillus prodigiosus* was then placed in the tube nearest the water inlet, and samples of water were collected from the other tubes and also from the outlet. In every experiment the bacillus was in a few hours detected in the outlet water; but it was never discovered in the water in the tubes. Apparently the microbes were first carried downwards into the shingly layer and then forward to the outlet. The results merely showed that polluting matter on a collecting area may pass downwards, get into a stratum of greater porosity, and then travel a considerable distance.

Afterwards the same organism was used in connection with the gravel pit referred to in the ammonium chloride experiment; but the bacillus never showed itself in the spring water. As there is undoubtedly a connection between this gravel pit and the spring (as was proved by the ammonium chloride test), possibly one might conclude that it was not of such a character as to permit of objectionable bacteria getting into the spring water. The author would not like to assert that this is the case; hence a negative result cannot be conclusive, though a positive result would leave no room for doubt.

The difficulty and trouble in carrying out such a test are very great, and the instances in which it is desirable are but few. Possibly in every case a comparatively simple experiment with fluorescein, together with a series of ordinary bacteriological examinations, would give more valuable and reliable information. The utility of the tests with salt, fluorescein, &c., cannot be gainsaid; and as the author has nowhere found any detailed references to the use of these substances it appeared to him that a paper on the subject would not be without interest.

Discussion.

The PRESIDENT (Mr. C. Sainty) remarked that the paper was a very interesting one; and it contained a lot of information of which many of the members were not exactly aware. It was a paper that, he was sure, would lead to a good deal of discussion.

Mr. WILLIAM MATTHEWS (Southampton) said there were only one or two points to which he wished to refer. With reference to the experiments Dr. Thresh had carried out, he indicated that he had arrived at the conclusion that the trend of the water was in a certain direction; and it would have been rather interesting to have known how many points of observation it was necessary to keep in view before arriving at this conclusion.

Dr. THRESH said the information would be found on a large diagram exhibited in the room.

Mr. MATTHEWS (continuing) said that early in the paper Dr. Thresh called attention to the necessity of having a proper examination of an area before an investigation could be carried out, and before any definite conclusion could be arrived at. He (Mr. Matthews) submitted that what Dr. Thresh suggested as being so very desirable should not be necessary at the time a well came under suspicion. His own view was that the conditions surrounding every water supply in the country should be available, whether or not there had been suspicion attached to them, and that examinations such as the author suggested should be going on more or less continuously, and not left until it was suspected there was something happening. They all knew that, with the outbreaks which had taken place, there had been no prior warning; and there were very few cases indeed where anybody had previously called attention to the fact that there was probably something amiss, and where, after such warning, it was a case of actual neglect. As a matter of fact, things were allowed to go along in a sleepy, self-satisfied sort of belief that everything was right, and when an outbreak had come it had been a terrible surprise for everybody. He thought the moral of Dr. Thresh's paper was that all these things ought to be kept under observation somewhat on the lines of which he had spoken. If his paper could only impress on water engineers the necessity of doing this, it would work a great deal of good. Really the paper was one that could not be very well criticized by the members. Dr. Thresh knew more about these matters than he (Mr. Matthews), for one, could ever teach him; and therefore he did not feel disposed to enter into it. It was an admirable paper, and one which was calculated to do an immense amount of good.

Mr. H. PRESTON (Grantham) remarked that some time ago Dr. Thresh himself suggested that a Sub-Committee should be formed in connection with the Association, for making records of underground waters—particularly with reference to the geological strata from which the supply came, and the quality of the water which was supplied; also the chemical analyses, and the results of the bacteriological examinations. This information would be of great assistance and value in their proceedings if it were done; because they found that expense was being incurred over and over again for the same purpose, just because no records had been made. There was one other point to which he should like to refer. In the first part of the paper, the author said he was "anxiously looking out for the records of any outbreak in which the contaminating matter had to percolate through several feet of compact soil before it reached the incriminated water, but as yet had been unable to find any such record." He

(Mr. Preston) hoped that, if such a record could be given, members would supply it; but he hoped also they would not be able to give it. Did the remark apply equally to modern filters? If filters were properly constructed and efficiently managed, were they really a safeguard against bacteria and epidemic?

Mr. F. W. Hodson (Loughborough) observed that the only thing which he was in doubt about was as to whether Dr. Thresh's test was going to land them into a great deal more trouble than they had had in the past. If water was tested from time to time, and the chemical analyses showed there was some variation in its constituents, then there was something to look out for; but to send out a bottle of water to an analyst, put a label on it and call it "Sample A," and then rely on the analyst to tell from his results, without other knowledge, whether or not the water was dangerous to health, was asking an impossibility; and the result was not worth the paper it was written on. The point of the paper was that they were now given full details of a simple test so much more delicate than any other—so delicate it seemed to him that 1 part in a thousand millions would give them a chance of tracing the sources of underground water, which must necessarily come from the surface somewhere, and with them the possible sources of contamination of a well.

Mr. H. E. Stilgoe (City Surveyor and Engineer, Birmingham) said he had been immensely interested in hearing Dr. Thresh's paper. The test described was so ample that it placed in the hands of everyone who used it carefully a means not only for the detection of pollution, but something which perhaps one ought not to say was more important, but it was nearly equally important—that was, to know where to put down a well so as to obtain the largest and best supply of water. The paper led them in this direction—that, by the use of fluorescein, they might discover in their underground water surveys that they had large bodies of water flowing through the chalk for a considerable distance right away in an opposite direction to that in which they expected to find it travel. If it were for that one point alone, Dr. Thresh's paper would be of immense value. For having put such a simple method of discovering pollution into their hands, they were still further indebted to Dr. Thresh.

Mr. Easton Devonshire (London) remarked with regard to the colour that had been shown the members, he was not quite sure whether he understood the arrangement of the two tubes. In years gone by, he (Mr. Devonshire) had had to measure the colour of water of all sorts, and he might state this as a fact: Supposing one were comparing colour in any water with distilled water, one might black the end of the distilled water-tube, leaving the sides open, and one would see nothing whatever through the tube, because the refraction of light would require the presence of some suspended matter in the water, however minute. What he should therefore like to know was whether Dr. Thresh was going to use distilled water in one tube and the fluorescein in the other. He (Mr. Devonshire) could quite understand that the contrast would then be very great—the one glass tube would be absolutely black, and the other would show light; and the fact that they would see nothing in one tube would show there was this suspended matter in the other tube. As he understood, however, Dr. Thresh put the same water in both tubes, and dropped in fluorescein in one case; and so might it not occur that he might be deceived by blacking the ends of the tubes? He (Mr. Devonshire) had found in practice, in order to get regular and comparable results from various waters in measuring colour, it was better to encase the tube in a sheath, and look through the ends only. Brass tubes with glass ends were practically as good as anything that could be used.

Mr. William Gore (London) gave particulars of some investigations of a theoretical nature on the flow of underground water in sand or upper chalk.

Mr. F. J. Mason, M.P., agreed with one of the previous speakers that, in the matter of water supply, chemical analysis was rapidly becoming of much less importance than the bacteriological question. The bacteria that they had to deal with were far more important than the chemical qualities of waters. In one part of the paper, Dr. Thresh stated that a few feet of compact soil would destroy bacteria; but, later in the paper, he (Mr. Mason) believed the author said that it was possible for the bacteria to live as long as ten days—that was to say, if the bacteria had been traced through a soil for a distance which would have taken them ten days to traverse, they had been found at the end of that time still alive. This led him to ask the author whether he could give him an opinion as to whether the bacteria were destroyed in their passage through the soil by chemical action, or were kept back by mechanical action, or were they affected by the action of other bacteria? He thought he was right in believing that, in the case of the ordinary sand filter, the purification was greatly due to the destructive action of one form of bacteria upon those which it was desired to remove.

Mr. Philip Palmer (Hastings) remarked that the paper to which they had listened was a most instructive one; and it brought the engineer back to the question of universal filtration. Where water was to a considerable extent polluted, in almost all cases careful filtration would exclude the greater part of the pollution, and make the water more or less safe for drinking purposes. He was strongly of opinion that they did not in this country make sufficient use of the rivers. If the Rivers Pollution Act was carefully carried out, his opinion was that the water of many of the rivers, with proper filtration, would be quite safe for drinking purposes. This brought them to another subject—that the water engineer ought to be somewhat of a chemist; and the larger undertakings ought certainly to have a chemist attached to their staffs. It was extremely necessary that nearly all waters should be constantly analyzed; and a bacteriological examination was very essential in addition to a chemical analysis. If this were done, they would not have the epidemics that arose from time to time, and pollution would be found before it had time to become dangerous.

Mr. James Davies (Croydon) said he should like to call attention to an interesting case that had arisen at Croydon. A well was sunk some twenty years ago at Addington; and there had been a recommendation before the Council recently—notwithstanding the fact that the well was 250 feet deep in the chalk, and there had been no infectious disease in the district for more than twenty years at least—that the water should be pumped, and passed through sand filters. To his mind, there was no organic matter at the depth where the water was at the present time; but he was afraid, in pumping it through sand filters, they might get a certain amount of contamination. Was it wise to take water from that depth, and bring it to the surface for filtration?

Mr. William Phelps (Shepton Mallet) said Mr. Palmer had referred to the little use made of the rivers of the country. He (Mr. Phelps) thought that rather than endeavour to purify admittedly polluted water by artificial filtration, the general tendency should be in the direction of a fuller knowledge and utilization of the large natural filters that they had at hand, or, in other words, the development of deep well waters. There was one point that had not been perhaps sufficiently insisted upon, though it had been hinted at, and that was the very erratic manner in which water passed through different strata. One gentleman had shown them, in diagrams, an ideal flow of water through a sandy subsoil, and had given them an idea of how very easily a well might be contaminated by polluting matter on the north, while if the well were 100 yards south of that source of pollution, it might possibly be free. This was in sandy subsoil. In the limestone of the Mendip Hills, the conditions were very different; and it was not safe to assume a general water slope. The water trickled in small streams in various directions, and bore no relation to the even flow which would come through sand to a well in the form of a pumping cone. A friend of his had once told him that, by removing a handful of gravel in an underground passage, it was possible for him to divert the water supply from a village; and from his own experience he thought this quite possible. With reference to what Mr. Hudson had said, perhaps Dr. Thresh could give them some idea of the maximum strength of fluorescein solution which it would be safe to use.

Mr. A. B. E. Blackburn (Sunderland) observed that he was rather interested in what Dr. Thresh had said about the well at New Herrington, in Durham, because it occurred in his own district of supply. In one part of his paper, Dr. Thresh made use of the expression, "where the subsoil was fissured." He did not know whether the author actually meant the subsoil. He (Mr. Blackburn) had always understood by the subsoil, the soil which was immediately under the vegetable soil. The author also referred to fissures in the rock formation. Of course, fissures varied very much in extent. In the magnesian limestone, for instance, the fissures varied from the minutest hair cracks to joints and master joints, and occasionally they did find what could be

called fissures of 1 or 2 feet in width, which were frequently persistent in direction for several hundred yards. In the deep wells in the magnesian limestone formation on the North-East Coast, there was an entire absence of harmful bacteria in the water—no doubt largely due to the great depth at which the water was found. From the bacteriological point of view, the depth was a great advantage; but he did not think it was necessarily so from a chemical point of view. He should like to ask Dr. Thresh whether he had found that waters in particular formations derived their chemical salts within the first few feet after entering the formation, and that the amount of salts did not continue to increase with the depth of rock traversed.

The PRESIDENT said he must join with other speakers in thanking Dr. Thresh most heartily for his admirable paper, which would be very useful to the members.

Dr. THRESH, in replying to the discussion, said that some of the questions arose out of the paper, and some did not. At any rate, he thought that all were more or less interesting. He would take the last one first, because, in his opinion, it referred to a matter of some importance. There was no doubt, when water was entering the soil, whether it was magnesian limestone or anything else (when he spoke of "subsoil" he meant everything that lay below the fertile portion at the top), it contained plenty of carbonic acid, and so dissolved the materials very actively. But he could not say there was not a limit to the time it would go on dissolving. He should, however, like to see the Association in possession of a large number of diagrams and results of analysis showing the difference in character of water as it entered the strata at the surface, and as it travelled in any particular direction, going deeper and deeper. They had, through the kindness of their friends in Lincolnshire, information showing that the farther they got away from the outcrop, the more salts the water contained, and that certain changes took place in the character of the water. In any formation, there was a change in the character of the water the farther they got from the outcrop where the rain fell upon it. It would be useful for water engineers and everybody interested in water supplies if they could map out the country, and get a lot of these sections and information referring to quantity and quality of water. In every case of water areas or of new water supplies, the information would be of the greatest value. As to the degree of danger of the pollution, it depended upon the length of time the colouring matter took to travel. If a considerable period elapsed, then the danger was very small; if the colouring matter only appeared in infinitesimal portions, the danger would be less than it was if it appeared in considerable portions. He was afraid one could not give any definite opinion just at present. This was a new kind of investigation that had been put in the hands of water-works engineers. It concerned the engineer chiefly, but to a less extent the chemist and bacteriologist. He would rather see the engineers searching out all possible sources of pollution themselves than wasting money in paying for chemical and bacteriological investigations which would not be of so much value. Here they had put into their hands a method whereby they could simply, and with little expense, make experiments, and ascertain whether polluting matter at any particular spots was liable to contaminate their supplies. Mr. Devonshire had remarked, regarding the glass tube apparatus in which he (Dr. Thresh) had made comparisons, that the tubes should be encased in brass. That would be absolutely useless, as it was the fluorescent appearance he wanted to get. The tubes must have black ends, and must have refracted light. What he did in making an examination was to take a sample from the well or source under examination, and keep that as his standard. If he used distilled water, which was nearly colourless, it would be a very simple matter for him to be deceived; but if he kept a sample of the original water before the fluorescein was applied, he had that with which to compare in making the examination. At the same time, he quite agreed that for most other purposes, a tube enclosed in brass was better than one exposed. Then another important question was asked as to whether well waters ought to be uniformly filtered. There were some cases in which it had been proved that wells with deep sources were liable to pollution, and pollution of a dangerous character; and the question had arisen several times recently, whether such wells should be abandoned, or whether filtration should be introduced. By filtration, 99 per cent. of all the bacteria in water could be removed; and so the chances of outbreak would be a hundredth of what they would be if the water was not filtered. He did not say they could make water absolutely safe; but they could make it 99 times safer than it would be without filtration. But it was better still to find out where the sources of pollution were, as it would be found in many cases that they could be remedied.

WATER GAS IN HOLLAND.

An article from the pen of Herr N. W. van Doesburgh, the Manager of the Municipal Gas-Works at Leiden, and Secretary of the Dutch Association of Gas Engineers, was printed a short time ago in "Het Gas," from which we have prepared the following account of the water-gas industry in Holland.

At the end of 1905, the population of the Netherlands was about 5,600,000, of whom roughly half were living within the districts supplied with gas. There were at that time 120 gas undertakings in existence; water gas being added to the coal gas in eighteen places. As two of these places, Amsterdam and Rotterdam, possessed two gas-works each, twenty separate works were supplying water gas; that supplied from five works being "blue" [*sic*—see below, however,], and that from the remainder being carburetted by the hot process. Twelve of the carburetted water-gas plants were made by Humphreys and Glasgow, one by the Economical Gas Apparatus Construction Company, Limited, one by Cutler and Sons, and one by Strache. Three of the blue water-gas plants were built by Kramers and Aarts, and two belonged to the Dellwik-Fleischer system.

The total production of gas in Holland during 1906 was about 11,300 million cubic feet, of which some 1900 millions was water gas. The consumption of coal was 887,400 metric tons; 621,200 tons of coke being made, and 394,300 tons remaining available for sale. The make of water gas was 1470 million cubic feet in the year 1905; so that the production during 1906 had increased by 29 per cent. The amount of mixed coal and water gas supplied was 8000 million cubic feet—*i.e.*, 71 per cent. of the total make of gas. The mixed gas was composed of 6100 million cubic feet of coal gas, 1500 million cubic feet of carburetted water gas, and 400 million cubic feet of blue water gas. In the mixed gas, the proportion of coal gas was, on an average, 76·3 per cent. The highest proportion of carburetted water gas (*i.e.*, 59 per cent.) was in the gas supplied from the Rotterdam works situated at Feyenoord. At Utrecht, the proportion was 40; and at Zwolle it was 37. The smallest proportion (of blue water gas) was 16 per cent., at Arnheim. The average proportion of carbon monoxide in the mixed gas was 13·3 per cent. by volume; the highest being 21 per cent., at Feyenoord, and the lowest 10·5 per cent., at Tilburg. The mixed gas was supplied through nearly 258,000 meters (1 meter per 6·9 inhabitants). No objections were made in any of the eighteen districts served with mixed gas respecting the carbon monoxide; and the usual number of accidents remained stationary. More men were injured during the emptying of the purifiers than before; so that more care is clearly desirable on the factories.

The consumption of coke during the manufacture of the 1500 million cubic feet of carburetted water gas was 25,382 metric tons in the producers and 11,229 tons under the boilers—figures which work out to 60·6 and 27 kilos. per 100 cubic metres (37·8 and 16·9 lbs. per 1000 cubic feet). In the manufacture of the 400 million cubic feet of "blue" water gas, the consumption of coke was 7689 and 3818 metric tons respectively—equal to 40·4 and 20 lbs. per 1000 cubic feet. Had no water gas been made, the additional volume of coal gas required—*i.e.*, 1900 million cubic feet—would have necessitated the carbonizing of an additional 179,360 metric tons of coal, and would have thrown on the market an extra 86,100 tons of coke over and above the 48,000 tons consumed in making water gas. Hence the production of water gas diminished the quantity of saleable coke by about 25 per cent. The average wholesale price of coke in Holland during 1906 was 1·86 marks per 100 kilos.

In the fifteen works manufacturing carburetted water gas, 15,100 metric tons of oil were consumed, equal to 36 kilos. per 100 cubic metres (or 22·5 lbs. per 1000 cubic feet). The oil came from Galicia and Texas, varying in price between 5·43 and 6·10 marks free on works. There is no tax on gas oil in Holland.

At the western gas-works of Amsterdam, and at Arnheim, where "blue" water gas was made, 322·3 metric tons of benzol and 1286 tons of gasoline were consumed in carburetting the mixed gas.

Maintenance of Gas "Arc" Lamps.—In a paper prepared for the third annual meeting of the Iowa District Gas Association by Mr. J. C. Grey, of Des Moines, he dealt with the maintenance of gas "arc" lamps. The conclusion he arrived at was that the ideal system of maintaining lamps would be to decide on a fixed amount per lamp per month, depending upon the cost of labour and material, the number of inspections, and the location of the lamps, and charge this sum for all lamps. A separate maintenance sheet should be kept for each lamp, and it should be numbered so that at any time one would be able to arrive at the amount of material used on any and all lamps maintained. His advice was to employ first-class help and have a bonus system; awarding cash prizes to the men cleaning most lamps, using the least number of mantles, and receiving fewest complaints.

INDIRECT LIGHTING OF SCHOOLS.

An article by Herr G. Himmel, of Tübingen, appeared in the "Journal für Gasbeleuchtung" some little time ago, in which the author drew attention to certain points that have to be borne in mind if the illumination of such a building as a school house by the indirect system of lighting, in the manner described by Dr. Schumann, of Munich (see "JOURNAL," Vol. XCVII., p. 742), is to prove satisfactory.

In the first place, Herr Himmel states that a school room fitted with indirect lighting burners must be at least 11 ft. 6 in. high. It must be painted a light colour—not a green in the manner commonly adopted, but a white with a very faint tint of yellow, and even the windows must be provided with curtains of the same shade. The paint must extend from the ceiling to at least 5 feet above the floor, but below that point the colour does not matter so much, as the amount of light reflected from the base of the walls is of no importance. For similar reasons, cupboards and the like not exceeding 5 feet in height may be used in the room and finished in any colour; but higher cupboards must be painted pale yellow, while cupboards having glass doors but dark contents ought to be provided with yellow curtains like the windows. Moreover, the paint must be as smooth as possible, in order that dust may be readily removed, for dust is the most serious of obstacles to the success of indirect lighting.

The design of the reflector used round the lamp is also a matter of great importance. The hemispherical reflector, as shown in fig. 1, or a conical reflector with sides at an angle of 45 degrees or more with the horizontal, as shown in fig. 2, is unsatisfactory, because much light is reflected back again into the reflector

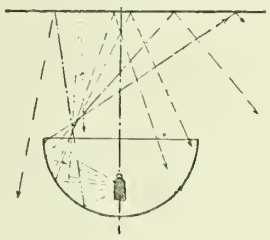


Fig. 1—Hemispherical Reflector.

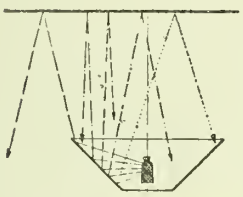


Fig. 2—Conical Reflector.

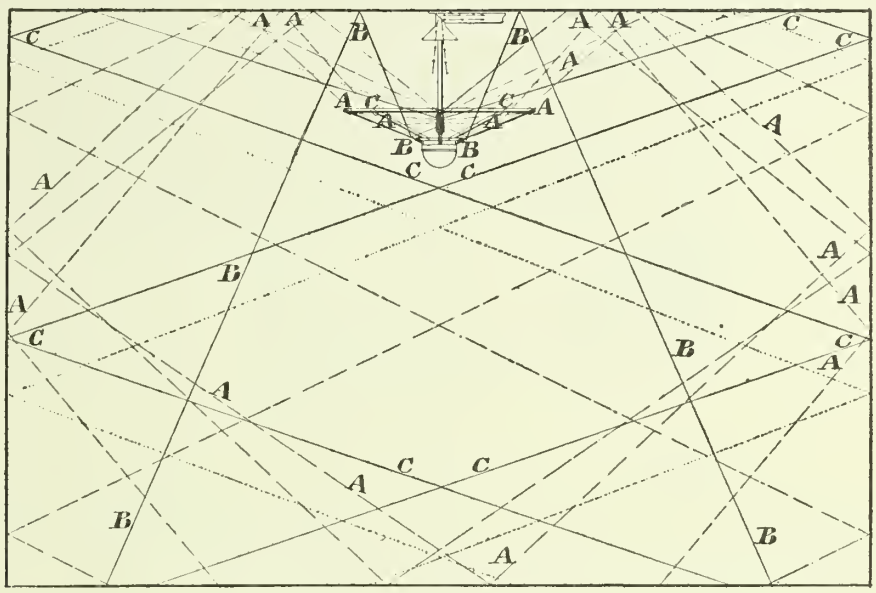


Fig. 3—Proper Type of Reflector.

itself, and only what few rays actually penetrate the reflector impinge at a favourable angle upon the tables. The proper type of reflector to use is one with its conical walls forming an angle of only about 25 degrees with the horizontal, as shown in fig. 3, and so arranged that the upper lip is on a level with the top of the mantle. By this system of construction, the most valuable light rays (marked A in the sketch) which issue at right angles from the mantle are thrown from the reflector on to the ceiling and then on to the walls; while the depending rays (marked B) pass from the reflector to the ceiling and next travel directly to the floor; whereas ascending rays (marked C) are reflected at once from the ceiling to the walls. It will be seen that no rays strike either the ceiling or the walls at right angles.

As the lamp so arranged will be over 6 feet from the floor of the room, difficulties may be made about keeping the reflectors clean. The author therefore proposes to construct them in the form of eight metal plates enamelled both sides, and hinged to the framework of the lamp on two pins disposed a little to one side of the major axis of each. In this way each section of the reflector can be rotated till the surface that originally pointed upwards, and has become dusty, points downwards, so that it can be cleaned from underneath. By fitting the hinges on one side of the axis, the plates lie steadily in position and do not chatter with vibration. An upturned incandescent burner, developing 400-candle power, erected 6 ft. 6 in. from the walls, and, according to the size of the room, from 13 to 16 feet from its neighbour, will give an amount of illumination on the desks ranging from 90 to 100 "lux."

Herr Himmel brings his article to a close by numerous calculations as to the cost of intensified or ordinary gas-light used in various schools in the manner described, at different original prices. As artificial light is not generally required in schools every evening, he does not advocate the use of pilot flames, but prefers to light the burners direct by a spirit torch with the aid of a temporary chain of flames burning on a pipe depending from the centre of the burner proper.

TREMORS FROM TRAMWAYS.

At Montpellier, M. Sar has had some trouble arising from earth tremors caused by the electric tramways of the town; and in one case they led to a gas explosion under the public roadway, which fortunately, however, caused no personal injury. This trouble induced him to communicate his views on the subject in a short paper read before the Société Technique du Gaz; and he advocated that the Society should take steps to have restrictions and regulations passed by the public authorities.

Gas companies, he says, suffer from tremors produced from heavy vehicular traffic over badly made or badly kept roads. This is in addition to damage frequently done to gas-mains and service-pipes from wandering currents from electric tramways. Such tremors, though often quite slight at first, are bound to affect and lead to the breakage of incandescent mantles in public lamps. Then, little by little, they loosen the lead joints of gas-mains and the connections of service-pipes. Escapes of gas ensue; and these are difficult to ascertain and remedy. Gas leakage taking place under electric tramways offers dangers in addition to the ordinary one of the gas finding its way into cellars, &c., because the gas is liable to be ignited by sparks from the electric current. All such dangers and difficulties should be guarded against by gas and electric companies agreeing to ascertain their presence by the use of instruments such as vibration recorders, and other apparatus of a similar kind.

Yorkshire Junior Gas Association.

Last Saturday had been reserved by the members of the Yorkshire Junior Gas Association for their summer gathering at Ripon. The long-continued wet and cold weather had told upon the number who had promised to attend, and its return in the early morning of Saturday still further thinned the attendance. Those who did venture had better weather and more enjoyment than was expected for them by the stay-at-homes. Members who were able to travel early in the day gladly accepted the invitation of Mr. W. T. Lancaster, the Gas Engineer and Manager of the Ripon Corporation, to look round his works. The Guildhall and Cathedral were duly visited; and in the afternoon, after awaiting the arrival of members who had been unable to get away in the early morning, all drove to Studley Royal, the Marquis of Ripon's seat. Here the afternoon and early evening were spent exploring the Park and ruins of Fountains Abbey, which together form one of the glories of the county.

The "Transactions" for the second session of the Midland Junior Gas Engineering Association have now been reprinted in book form from the "JOURNAL;" and Mr. James Hewett, the Hon. Secretary, intimates that a few copies are available for honorary members and others interested in the Association. The prices, post free, are 3s. 9d. each for cloth bound, and 2s. 8d. for paper covered copies. As Mr. Hewett rightly remarks in his circular-letter announcing the publication, the book constitutes "a permanent record of a most successful session."

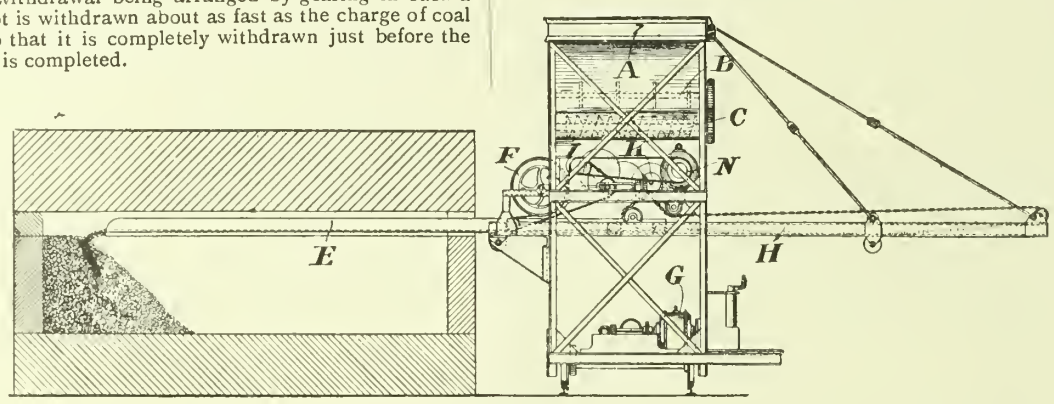
REGISTER OF PATENTS.

Charging Coke-Ovens, &c., with Coal.

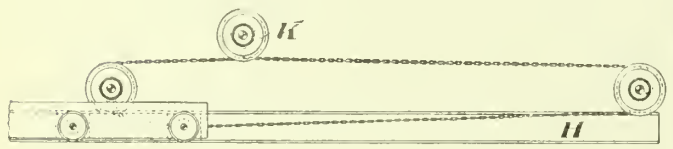
JENKINS, WILLIAM J., of Retford.

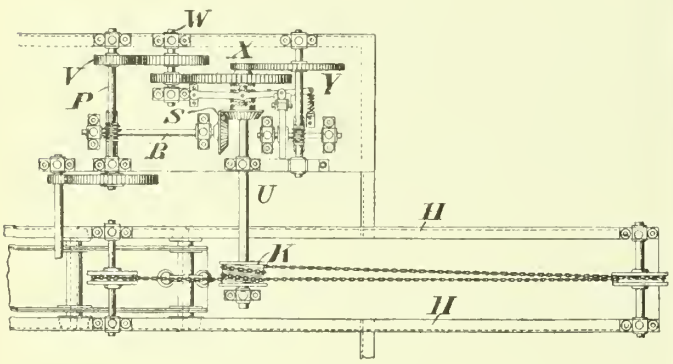
No. 13,608; June 13, 1906.

This invention relates to mechanism by means of which coke-ovens, &c., may be charged from one or both ends with coal to any required depth by a machine of the projector type—using a tray or shoot of suitable length arranged at a height varying with the depth of the required layer of coal, and carried on runner wheels, or else supported near one end and of sufficient strength to carry itself as a cantilever. The tray or shoot is run in by hand or mechanically at any speed to the end of its stroke near the farther end of the oven, and then the charging commences. As soon as the coal begins to run along the shoot from the projector or charging machine, the shoot is slowly withdrawn from the oven; the speed of withdrawal being arranged by gearing in such a manner that the shoot is withdrawn about as fast as the charge of coal fills the oven, and so that it is completely withdrawn just before the charging of the oven is completed.



Jenkins's Coke-Oven Charger.





The illustrations are an elevation of the charging-machine supported on wheels which run along rails laid on the floor in front of the oven; a plan of the gearing for moving the tray into and out of the oven; and an elevation of the tray with the rails for supporting it, and the chains for connecting the shoot to the travelling gear.

E is the tray along which the coal slides into the oven when being projected by the projector F. G is the motor for propelling the machine along the rails. H is the hanging frame or support in which the shoot is carried by means of rollers, with a chain attached to the back end of the tray and to the drum K around guide pulleys. N is a motor for driving the projector and the gear for operating the shoot by means of a belt driving on to a shaft which in turn drives, by a pair of spur-wheels, a shaft P.

In order that the shoot may have two speeds of travelling—fast when entering the oven, and slow when returning—the shaft P is fitted with two drivers. One is for the forward stroke, being a spur-pinion V driving a spur-wheel which is keyed on a shaft W, on which is also keyed another spur-wheel gearing with a spur-wheel X, which runs loose on the drum-shaft U; the other drive is for the slow return, which is regulated to suit the flow of the coal. This consists of a worm gearing with a worm-wheel on the shaft R, on which is also keyed a bevel or mitre wheel S, which drives a corresponding wheel running loose on the drum-shaft U. The wheels which run loose on the shaft U are each fitted with a clutch face, between which is arranged a double clutch Y sliding on a square or feather keys on the shaft U.

The hopper A, for holding the coal, would be fitted with an agitator B to ensure the coal falling into the feeder C, which is of the screw type and which delivers the coal into the projector. The agitator and the feeder would be driven by gearing from the motor N; and there would be a clutch for throwing them into and out of gear by a hand lever arranged in a convenient position for the attendant. In operation the hopper is first filled with coal, and the machine placed opposite the oven to be charged. The projector is then set in motion, running at its maximum speed; and the tray or shoot E is run into the oven by means of the chains and gearing. The coal is then fed by the feeder B into the projector F, which in turn projects the coal along the tray E to the farthest end of the oven, where it stacks or piles up to the level of the tray. Then the projector commences to slow down, and the tray starts on its return stroke—the slowing down of the projector and the speed of the tray being so regulated that a level bed of coal is ensured for the full length of the oven when the charge is completed.

Prepayment Mechanism for Electric and Other Meters.

ALLAN, J., of Chislehurst, Kent.

No. 14,342; June 22, 1906.

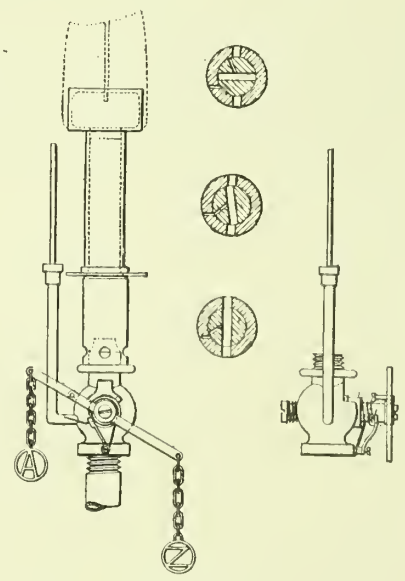
This prepayment mechanism, applicable to electric, gas, or other meters, consists of a rotating spindle as part of the driving or registering mechanism, whereby, on the insertion of a coin, the operator obtains the supply of a given quantity of gas, electricity, or whatever the meter is intended to supply or register. The invention consists in an improved construction of the prepayment device described in patent No. 25,114 of 1903—particularly with regard to the setting and returning gear, and is intended primarily for use in conjunction with electric current or energy meters.

Self-Lighting Means for Gas-Burners.

BRAUNSTEIN, J., of Highbury New Park, N.

No. 12,524; May 29, 1906.

This invention relates to pilot devices of the class comprising a tap which is combined with the burner and is so arranged that one complete operation of it permits the gas to flow fully to the pilot-jet and partly to the main burner, while a partial operation the reverse way cuts off the supply to the pilot-jet and opens fully the passage to the main burner, from which the gas supply is completely shut off by a subsequent action finishing the latter operation, and wherein the first operation is effected by a pull-chain against a spring, which accomplishes the second operation by its reaction on the release of the pull-chain, and wherein, also, the remaining operation is performed by another pull-chain independently of the spring. The invention is mainly directed to the arrangement of the spring, with the object of providing a device of simple and compact construction.



Braunstein's Self-Lighter for Gas-Burners.

Such a device is shown in the illustration adapted as an attachment to an incandescent burner fitted with a self-lighting mantle having the igniter upon it at such a point that it is below the head of the main burner—such mantle forming the subject of a separate patent.

Preparation of Pure Methane or of a Gaseous Mixture Rich in Methane.

SABATIER, P., of Toulouse, France.

No. 13,861; June 16, 1906. Date claimed under International Convention, June 17, 1905.

The gases issuing from the Riche gas-generators (the patentee remarks), or other similar generators for inverted distillation, supplied either with wood, wood waste, cellulosic detritus, and so forth, on an average present the following composition:—

	Per Cent.
CH_4	15 to 10
CO	20 to 22·5
CO_2	20 to 22·5
H	45

And the present invention has relation to processes of the kind in which gases from such generators are transformed into methane by passing over reduced nickel at a suitable temperature in the presence of approximately the theoretical quantity of hydrogen.

In accordance with the present invention, the mode of operation is as follows: On leaving the generator, the gases, purified by their passage over copper turnings heated to about 600° C., are conducted over nickel, cobalt, or iron, reduced from their oxides (or a mixture of these bodies), and raised to a temperature approximating 500° C. At this temperature, the carbonic oxide becomes partially transformed into carbonic acid (with deposit of carbon upon the metals) and partially into methane. In this manner, after the passage of the Riche gases over the heated reduced nickel, cobalt, or iron, a mixture containing exclusively hydrogen, methane, and carbonic acid is obtained; the water that is formed separating by condensation. When the deposit of carbon destroys the reaction, a second apparatus, which is not carburized, is utilized, and the carburized metal may be regenerated by causing the passage of a current of steam, which becomes converted into carbonic acid, hydrogen, and methane, by carrying off the carbon retained by the metals. These gases are added to the mixture of hydrogen, methane, and carbonic acid obtained directly.

The gases thus produced as a whole then receive an addition of hydrogen of such an amount that, together with the hydrogen of the mixture, it is about four times larger than the carbonic acid.

The fresh mixture is then conducted over nickel, cobalt, or iron reduced from their oxides (or over a mixture of these metals) heated to a temperature varying between 250° and 500° C. In these conditions, the carbonic acid and hydrogen become transformed into methane and water. The water is eliminated by condensation, and finally pure methane is obtained.

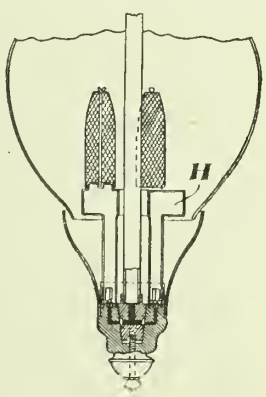
This methane may be, the patentee concludes, employed industrially for any uses of which it is capable. In particular, it is possible to utilize it for the manufacture of an illuminating gas of very high calorific and illuminating power by adding acetylene and hydrogen to it. These substances, passing with the methane over iron, nickel, cobalt, or copper, reduced from their oxides at a temperature varying between 50° and 180° C., finally give a gas of high illuminating power.

Gas Lamps and Burners.

HELPS, GEORGE, of Nuneaton.

No. 13,986; June 19, 1906.

This invention relates to gas-lamps provided with annular mixing-tubes; the upper surface of the annular box H supporting two or more mantles. The gas supply pipe passes loosely through the centre of the burner-head and burner-tube and finishes with a nipple, plug, or socket, as the case may be, which is in itself not new. The burner-



Helps's Gas Lamp and Burner.

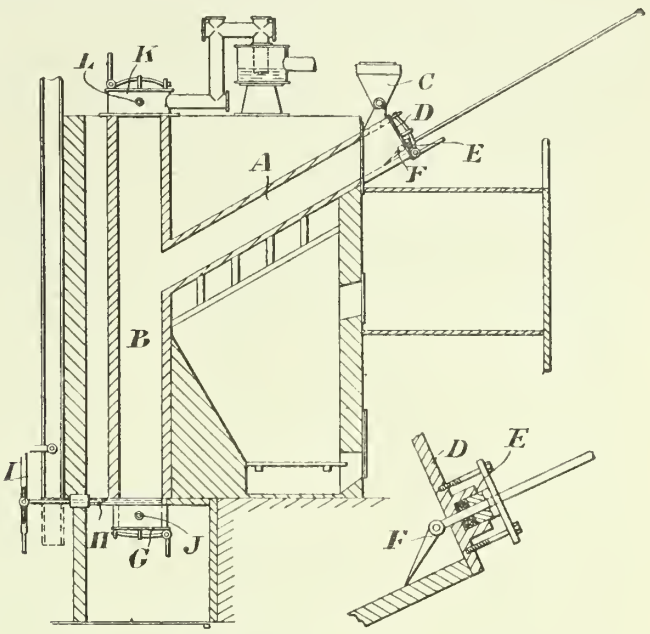
tube rests on, or is attached to, a movable plug or socket in such a manner that when it is desired to remove the mantles from the lamp, this may be done without removing the globe—the burner sliding over the central gas supply pipe.

Production of Coal and Water Gas.

THOMAS, W., of Vancouver, British Columbia, and THOMAS, P., of Wellington, Somerset.

No. 16,498; July 21, 1906.

This invention relates to a process of gas making in which coal is first partly distilled in a horizontal or inclined portion of a retort and then transferred to a vertical portion. The charge of coal is spread on the bottom of the inclined or horizontal portion of the retort and afterwards pushed forward and allowed to fall into the open end of the vertical part of the retort, where the distillation is rapidly completed, "owing to the favourable conditions obtaining." These operations are continuously repeated; the coal gas generated in the inclined or horizontal portion of the retort not passing through the contents of the vertical portion of the retort. The patentees say they prefer to provide the retort used for the process with means for the enrichment of the coal gas and for the production of water gas from the coke in the vertical portion of the retort, and its enrichment.



Thomas's Combined Inclined and Vertical Retort.

The inclined portion of the retort A, in which the primary distillation or first part of the process takes place, opens into B, the vertical part of the retort. C is a hopper fitted with a worm by which the coal is introduced into A. D is a self-sealing door through which the coal may be introduced (if desired) by hand. E is a stuffing-box adapted to receive a pusher or slice F, by which the fresh coal can be distributed, the partly distilled coal may be caused to assume a fresh position in the inclined portion of the retort, and by which it may afterwards be thrust into the vertical part of the retort. G is a self-sealing discharge door at the bottom of the vertical portion of the retort; and H is a slide, operated by a lever I, for retaining as much coke as may be desired when the discharge door G is opened. J is an inlet for superheated steam; K is a second self-sealing door at the upper end of the vertical part of the retort; and L is an inlet for the supply of a spray of oil as an enricher.

The inclined and vertical portions of the retort having been heated to the required temperature, the vertical part is filled with coke to a suitable height—say, 3 feet or so. A charge of coal is then introduced into the inclined portion, either automatically or by hand. The coal is then heated in the inclined portion for two hours or so, during which period its position in the inclined portion may be shifted. It is then thrust by the pusher or slice F into the vertical portion, "where it gives off large quantities of gas and is rapidly distilled." When the active distillation has somewhat subsided, a second charge of coal is fed into the inclined portion; and when this second charge has been in for (say) an hour or so, "the first charge, which was pushed into the vertical portion, will have become fully carbonized and incandescent, and, by reason of the preliminary distillation that it has undergone in the inclined portion, the resulting coke will be in such condition that if steam be admitted the latter will be capable of readily penetrating the mass of incandescent coke without waterlogging of the coke taking place." Consequently, if it is desired to generate blue water gas, superheated steam may be admitted at J for a given period—say, six minutes or so, according to the heat; and when the coke has recovered, another run for the production of water gas may take place. The water gas may be allowed to mix with the coal gas that is being generated in the inclined portion of the retort, or the coal gas can be led away separately. In order to carburet the water gas or enrich the coal gas, as may be desired, distillate or other enricher can be introduced from time to time in a fine spray at L.

The patentees conclude their specification by saying: "The first portion of the retort may be horizontal instead of inclined; but the latter is preferable, inasmuch as it allows the coal, on being introduced, to gravitate to its proper position in this portion of the retort, and thus minimize the amount of labour required for its manipulation. Several retorts of the form described herein may be combined in one bench—the vertical portion of each retort being connected only to its own inclined or horizontal portion."

Treatment of Gases Containing Sulphuretted Hydrogen to Obtain Sulphur.

TYERS, C. E., HEDLEY, J., and the UNITED ALKALI COMPANY, LIMITED, of Liverpool.

No. 25,976; Nov. 16, 1906.

For the purpose of obtaining sulphur from sulphuretted hydrogen, or gases containing sulphuretted hydrogen, the sulphuretted hydrogen, or gas containing it, has been mixed with air and the mixture passed in contact with a substance such as bog iron ore or bauxite. The patentees claim that they have found that the obtainment of the sulphur from

sulphuretted hydrogen, or gases containing sulphuretted hydrogen, is more readily effected, and a better yield obtained, if, in place of contact substances, such as bog iron ore and bauxite, they use as contact substance, or catalytic agent, a salt or ore of titanium, or other titaniferous substance, either in the crude or in a prepared state. For instance, titanic iron ore or rutile might be used, or titanium oxide mixed with broken bricks, or broken bricks might be impregnated with titanium chloride.

Regenerator Furnaces.

Brooke, R. M., of Elland, Yorks.

No. 14,637; June 27, 1906.

The main objects of this invention are "to more fully utilize the heat in the gases leaving the setting, for heating the secondary air on its way to the combustion chamber, and to better regulate the distribution of the heat applied to various part of the retorts, while obtaining a strong and durable construction of regenerator."

The method by which these are attained consists, firstly, in keeping the hot gases in each of the compartments formed by the stay walls of the setting under separate control while passing through the regenerator; and, secondly, in keeping the secondary air passing through one series of flues in the regenerator separate from the secondary air in other flues until it reaches the combustion chamber. By thus dividing the secondary air and waste gases into separately controlled streams, the draught through each compartment of the setting, and thereby the heat in each of such compartments, can be more effectively controlled, it is said, than has hitherto been the case.

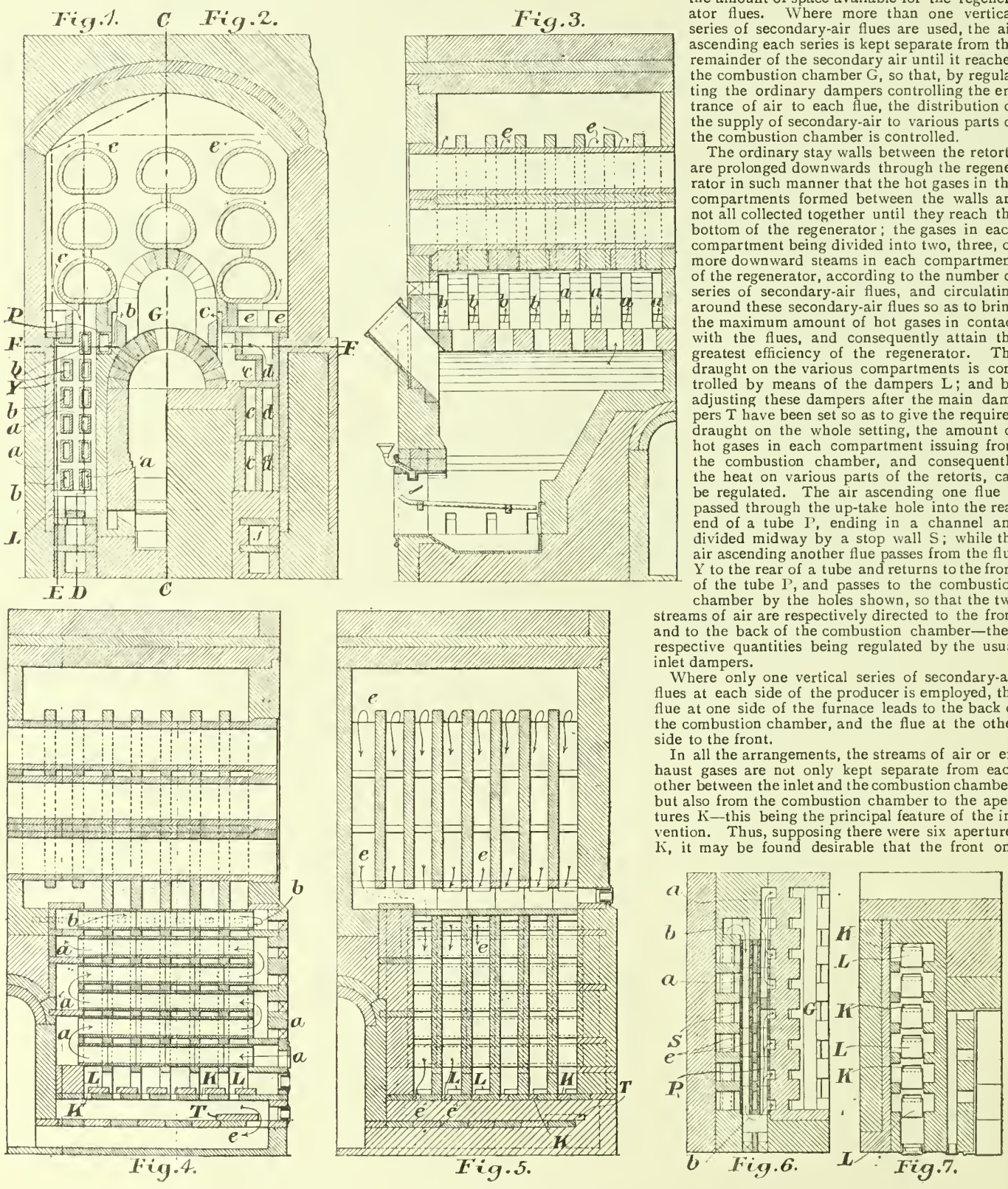
The illustrations show one mode of applying the invention to a regenerative furnace with setting of eight retorts. Figs. 1 and 2 are half-sections on the lines A A and B B of fig. 4. Figs. 3, 4, and 5 are sections taken on the line C C, C D, and C E of fig. 1. Figs. 6 and 7 are sectional plans taken on the lines F F and G G of figs. 1 and 2.

The arrows *a b c d* represent the course of the secondary air, and the arrows *e* the course of the waste gases. The secondary air is admitted at the front of the regenerator and travels backwards and forwards inside one or more vertical series of horizontal tubes of any suitable shape made of fire-clay blocks, tiles, bricks, or tubes—the number of series, and the number of tubes in each series, being dependent upon the amount of space available for the regenerator flues. Where more than one vertical series of secondary-air flues are used, the air ascending each series is kept separate from the remainder of the secondary air until it reaches the combustion chamber G, so that, by regulating the ordinary dampers controlling the entrance of air to each flue, the distribution of the supply of secondary-air to various parts of the combustion chamber is controlled.

The ordinary stay walls between the retorts are prolonged downwards through the regenerator in such manner that the hot gases in the compartments formed between the walls are not all collected together until they reach the bottom of the regenerator; the gases in each compartment being divided into two, three, or more downward steams in each compartment of the regenerator, according to the number of series of secondary-air flues, and circulating around these secondary-air flues so as to bring the maximum amount of hot gases in contact with the flues, and consequently attain the greatest efficiency of the regenerator. The draught on the various compartments is controlled by means of the dampers L; and by adjusting these dampers after the main dampers T have been set so as to give the required draught on the whole setting, the amount of hot gases in each compartment issuing from the combustion chamber, and consequently the heat on various parts of the retorts, can be regulated. The air ascending one flue is passed through the up-take hole into the rear end of a tube P, ending in a channel and divided midway by a stop wall S; while the air ascending another flue passes from the flue Y to the rear of a tube and returns to the front of the tube P, and passes to the combustion chamber by the holes shown, so that the two streams of air are respectively directed to the front and to the back of the combustion chamber—their respective quantities being regulated by the usual inlet dampers.

Where only one vertical series of secondary-air flues at each side of the producer is employed, the flue at one side of the furnace leads to the back of the combustion chamber, and the flue at the other side to the front.

In all the arrangements, the streams of air or exhaust gases are not only kept separate from each other between the inlet and the combustion chamber, but also from the combustion chamber to the apertures K—this being the principal feature of the invention. Thus, supposing there were six apertures K, it may be found desirable that the front one should be opened wider than the others, in order to increase the draught through the front compartment, and thereby the quantities of both secondary air and producer gas burnt under that compartment, for the purpose of compensating for the loss of heat by radiation from the front of the retorts, which loss does not occur in the other compartments. Then, the general draught, as governed by the damper T, representing seven parts, the draught through another one might, for example, be represented by two parts, and through the other five by one part each. This will be found much more effective than



Brooke's Regenerator Furnace.

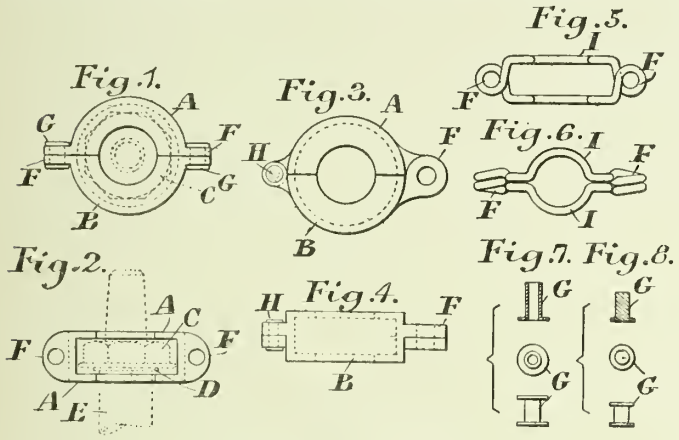
varying the sizes of the air-ports leading to the combustion chamber, since the edges of the ports at the points of greatest heat are most liable to burn away—thus increasing their areas. It has been found impracticable, the patentee remarks, to employ dampers for partially closing such air-ports—the great heat fusing the dampers fast against the ports; whereas in his arrangement the dampers L are in a comparatively cool and accessible position.

Preventing Surreptitious Tampering with Meters.

GLOVER, THOMAS, of Queen Victoria Street, E.C.

No. 17,258; July 31, 1906.

This invention relates to locks for sealing the union joints of gas-meters; the object being to construct such appliances in a more simple manner, and to enable them to be sealed by lead rivets or eyelets, on which may be impressed the mark of the company owning the meter.



Glover's Meter-Union Lock.

In figs. 1 and 2, two half-circle troughs A B completely enclose the screw nut C connecting the joint, and also the flange D, on the pipe E, attached to the meter. The troughs are provided at their ends with holed lugs F, connected together by passing the lead rivet or eyelet G through the holes and pressing or swaging one or both ends out over the lugs. Thus it is impossible to get at the nut C to disconnect the joint without first breaking the seal and indicating that the joints had been tampered with.

The half-circular troughs may be hinged together as at figs. 3 and 4 by a hinge-pin H. In this case only one rivet or eyelet as a seal need be employed.

According to figs. 5 and 6, wires form the means of encircling the joint; and these are in two pieces, bent or curved at I and provided with extensions terminating in loops F. By placing two together as at fig. 6, encircling the pipe from the meter and the supply pipe, and encircling the nut C and flange D, they can be sealed together by a rivet or eyelet as a seal being passed through the eyes or loops F, and squeezed on.

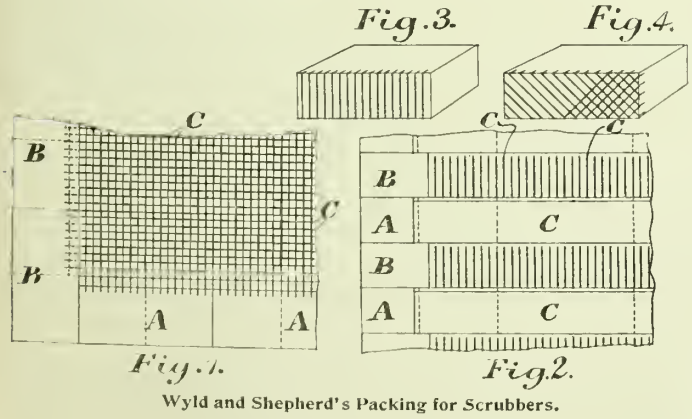
Fig. 7 shows a sectional elevation and plan of an ordinary hollow lead eyelet before being used, and an elevation of the approximate contour as a seal after being used. Fig. 8 are similar views of a solid lead rivet.

Towers to Absorb or Eliminate Chemical Vapours.

BRADFORD CORPORATION, WILFRED WYLD, of Frizinghall, and STEPHEN W. SHEPHERD, of Shipley.

No. 19,001; Aug. 25, 1906.

This invention relates to a method of packing towers and other apparatus used for the absorption or elimination of chemical vapours—more particularly is the system devised as a substitute for towers packed with coke or other bulky material, such as bricks, earthenware plates, blocks, or tiles. The system is designed to prevent blockage or obstruction to the flow of gas and liquid, consequent upon the usual superincumbent masses compressing, disarranging, or solidifying the lower portions in methods hitherto used, and also "to provide a permanently increased amount of useful surface and comfortable passage in a minimum of space; thus dispensing with the huge erections hitherto packed with coke, bricks, and the like."



Wyld and Shepherd's Packing for Scrubbers.

Fig. 1 represents the sectional plan of a few courses of scrubbing material, using vertical strips; fig. 2 is a sectional elevation; fig. 3 shows a brick or block with vertical grooves; and fig. 4 shows a brick or block with oblique grooves, which may be inclined all one way or both right and left.

Having erected the necessary portions of the outer casing of the apparatus, the usual interior supporting walls are built to a suitable height above the bottom gas connection. On two opposite walls are placed a course of grooved bricks A, the grooves facing inwards; and then the other two walls, to complete the course, may be built of plain bricks B (which are preferably wider than the grooved bricks, as shown in fig. 2), thus forming supports for the ends of the glass strips C of the succeeding course. The grooved bricks are cut with any desired number of vertical or oblique grooves on one face (as shown by figs. 3 and 4) of suitable depth and width for the reception of the glass strips. This course of grooved bricks is in position ready for the insertion of the desired number of glass strips, which stretch from wall to wall, so as to rest upon the supports given by the under-course of wider bricks B. The strips are of less depth than the length of the grooves into which they fit, so as to secure a space between each succeeding course and avoid the dangers of disarrangement by the structure above resting thereon.

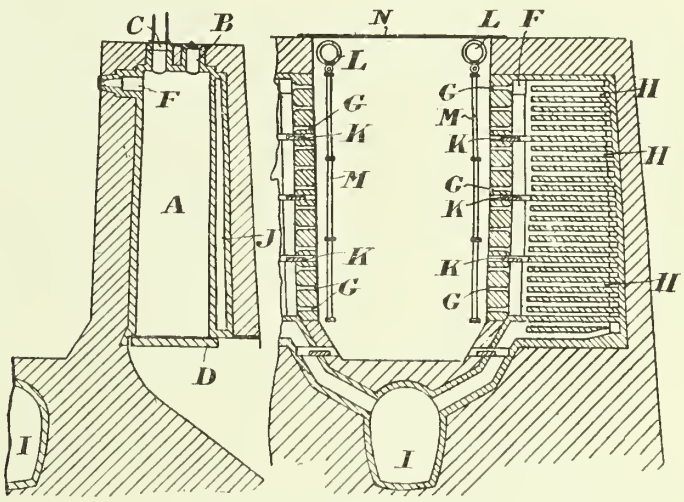
The first layer of scrubbing strips being now in position, a second course is commenced by laying upon the bricks B another course of grooved bricks A, and again completing this course as described.

Vertical Coke-Oven.

BARLEN, R., of Duisburg-Wanheimerort, Germany.

No. 26,542; Nov. 22, 1906. Date claimed under International Convention, Feb. 9, 1906.

This invention relates to a vertical oven for the production of coke, the peculiarity and advantage of which, as opposed to ovens situated horizontally, and as compared with vertical ovens, consists in the bye-products being protected from decomposition during the production of the coke in a more suitable manner than formerly, and thereby "a rapid and uniform coking of the carbon is guaranteed."



Barlen's Vertical Coke-Oven.

The ovens are arranged in pairs, in such a way that two rows have their backs turned to each other. Each separate oven has a shaft A for the coal to be coked; and between each two of such shafts a heated vertical wall, with the necessary heating flues, is arranged. The filling of the chamber A is effected through the charging openings B. The outlet-pipe C serves for conducting into the apparatus the gases which serve for obtaining the bye-products. The chamber is closed below by a sliding-damper D, by opening which the oven is emptied and the coke goes direct to the place of loading over the inclined plane E. The opening F connects the shaft of the oven with the flues of the oven-wall, and is only used when beginning the heating, or, if it is wished to forego the winning of bye-products, to conduct the gases, as formed, to the outlet direct through the flues.

Admission openings G, arranged uniformly one over another in a row, are provided in the wall of the oven for the gases which return from the purifying apparatus, and are provided with bunsen-burners. A row of horizontal heating flues H is likewise arranged in the oven-wall vertically one over another, and provided with a vertical outlet J. This latter again is connected with the channel I, which leads to the chimney. Horizontal sliding-dampers K are arranged at certain vertical intervals, by the correct adjusting of which the gases are for the most part prevented from sinking or being drawn downwards, whereby a non-uniform heating of the vertical wall could occur. The hot gases are supplied to the oven from the purifying apparatus through the distributing pipes L, from which they come in vertical pipes M, to which burners G are connected. The chamber N, situated between the two rows of ovens in which the pipes M are located, is covered above, whereby it is attained that the air which is required for the combustion is warmed beforehand, and the gas-burners lie protected.

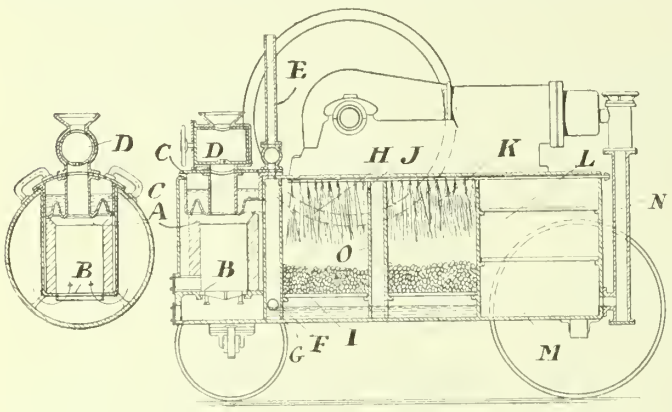
By the arrangement of the burners in the vertical wall and by the horizontal flues, uniform and intensive heating of the vertical walls is said to take place. The coals situated at the walls are first coked, and the gases generated find a relatively cool outlet in the middle of the coal cakes. In this way, as well as by the path through the highly-heated parts of the oven being also a very short one, the gases "remain protected from decomposition, and consequently remain more valuable than in the case of other coke-ovens."

Combined Gas-Producer, Purifying Apparatus, and Gas-Engine.

HURLEBUSCH, H., of Hanover.

No. 29,231; Dec. 22, 1906. Date claimed under International Convention, Jan. 15, 1906.

This is a modification of patent No. 667 of 1906, which described a gas-producer mounted on the same base as the purifying and cooling chamber, but separate therefrom; whereas in the present invention both the producer and the purifying and cooling apparatus are enclosed in a single outer vessel, in the form of a boiler, while the apparatus for generating, purifying, and collecting the gas is inserted in the containing vessel, and the walls of the latter protect the producer from loss of heat.



Hurlebusch's Portable Gas Plant.

In the construction shown, an outer vessel is supported on wheels, with the engine mounted directly on it for a base. The gas required for working the engine is made in the producer A, which comprises the furnace B, the boiler or steam generator C, with its corrugated bottom resting on the former, and the charging drum D rotated by a hand wheel. The steam produced in the boiler is conducted to the spaces which lie at the side of the furnace, and which serve for collecting and drying it. The steam then passes into the ash-box, and through the grate into the furnace, where the gas is formed. The gas produced when the engine is not working is led into the open air. When the engine is to be fed, the tap in the exit tube E is closed. The gas then proceeds downwards and enters through the opening F into the outer vessel, in which the apparatus for cooling, scrubbing, and purifying the gas is contained. The bottom of this vessel is covered with water up to a height regulated by the outlet pipe G. The gas comes into contact with the surface of the water at the bottom of the first purifying chamber H, and thereby loses some of the particles of dust carried over from the furnace, and is at the same time somewhat cooled. It then passes through the grating I, on which there are pieces of coke or other material suitable for the purpose, which is kept moist by a water-jet. From the first scrubber the gas passes through the opening J into the second scrubber, which is arranged like the chamber H.

The gas, purified and cooled to the temperature for use in the compartments H and K, then passes into the chamber L, in which sawdust is placed on several gratings. This takes out of the gas the last traces of dirt and dust. M is the collecting chamber for the gas, from which it enters the cylinder of the gas-engine through the tube N provided with a cover at the bottom, which can be removed in order to facilitate the cleaning of the tube.

The partition O of the scrubber H has an opening through which the chamber H, the channel, and the chamber K communicate with one another. The opening, however, lies relatively so low that it is kept permanently sealed by the water. The direct passage of the gas from the chamber H into the chamber K is therefore prevented.

APPLICATIONS FOR LETTERS PATENT.

15,065.—STEVENSON, G. R., and HUNTER, R. G., "Manufacturing gas for heating purposes." July 1.

15,075.—ROSE, A., and BELLAMY, W., "Nozzles for inverted burners." July 1.

15,117.—SCHATZ, E., "Automatic transfer of measured quantities of gas to gas-testing apparatus." July 1.

15,124.—READ, J. C. C., "Gas-stove." July 1.

15,127.—ROLLIN, C., "Gas-turbines." July 1.

15,141.—SCHMIDT, P., and DESGRAZ, A., "Gas-heated furnace." July 1.

15,149.—STOPFORTH, R., and LENDRUM, A., "Mantles." July 1.

15,160.—TROUBETZKOY, L., "Acetylene-generators." July 1.

15,172.—BLACK, J., and LENNOX, A. H. & H., "Washing gases." July 1.

15,245.—CUTLER, S., "Water-tube gas-condensers." July 2.

15,314.—NUSENBLAT, S., "Carburetting air." July 3.

15,362.—DEUTSCHE CONTINENTAL GAS GES. and MUCKE, F., "Regulating devices for gas-burners." July 3.

15,376.—FISCHER, H., "Incandescent burners." July 4.

15,377.—DAVEY, H., "Plug taps for gas." July 4.

15,433.—ENNIS, J. G., "Gas-engines." July 4.

15,454.—ALLEN, T. G., "Gas-burner taps." July 4.

15,522.—MASKELYNE, J. N., "Operating gas-taps." July 5.

15,533.—LÉBÉDEFF, N., and POMERANZOFF, B., "Regenerative furnaces." July 5.

15,536.—THOMPSON, W. P., "Immersion baths for incandescent mantles" A communication from the firm of R. Eisenmann. July 5.

15,543-4.—VIEU, R. M., "Incandescent burner." July 5.

15,554.—SCOTT-MONCRIEFF, W. D., "Smokeless fuel." July 6.

15,555.—DAVIES, W. M., TYSOE, J., and DUNPHY, A. L., "Repairing gasholders in action, while inflated with gas." July 6.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Capital Expenditure of Gas Companies and Local Authorities.

SIR,—I cannot but think that ill-service is done to gas companies by any attempt to ignore or minimize the significance of the figures relating to capital indebtedness of the two classes of gas undertakings to which you referred in your last issue. No explanation can disguise the fact that local authorities are fast reducing their capital indebtedness per million cubic feet sold—at such a rate indeed as to have already brought some of them within a reasonable distance of its total extinction. Cases might be quoted in which this reduction has largely exceeded one-half since 1882; and the Board of Trade returns show that the average indebtedness of the 148 local authorities included in the returns for that year has been brought down from £712 to about £401 per million cubic feet sold. Stated in another way, the gas sold by these undertakings has increased (speaking roundly) from 21 to 51¾ million cubic feet, with an actual increase of indebtedness of 5¾ millions sterling, or at the rate of £188 per million cubic feet sold. Should so favourable a state of things continue, the time must inevitably come when these local authorities will be in a position to supply gas at much cheaper rates than the companies can hope to attain to. But is it not desirable that the latter should put their house in order by keeping down capital expenditure by every practicable means consistent with increasing the business, so that they may be in some measure also prepared for evil times should these be in store?

15, *Victoria Street, S.W., July* 12, 1907. CHAS. HUNT.

[Mr. Hunt's letter is not an answer to the remarks on the subject of capital expenditure in the first editorial in last week's "JOURNAL." Our question was: "Is it fair to make use of these [comparative capital] figures without an explanation of all the circumstances that go to swell the average capital expenditure of gas companies in comparison with local authorities?" The figures Mr. Hunt now quotes only show wise capital management on the part of the 148 local authorities included in the returns for 1882—nothing more; and that is not the point over which objection was raised. And to make the present figures of any further value, Mr. Hunt should exercise his *penchant* for statistical investigation, and take 148 companies *of equal calibre* to the local authorities concerned, and show us what has happened in the meantime in connection with their capital expenditure—of course, making allowance for inflations produced by capital conversion.—ED. J.G.L.]

Distribution of Gas at Increased Pressure.

SIR,—Mr. Newbigging is not the last but he is certainly the last gas engineer save one of whom, or of whose work, I could speak or think deprecatingly. His "Handbook" was for a not inconsiderable time the only work I possessed upon gas technology, and I should be sorry to forget either its teachings or its usefulness.

But the fact remains that there are gas engineers, and progressive ones too, who do not yet realize that, at any rate, in most large towns, there are consumers with requirements to be satisfied during the whole twenty-four hours. We ourselves find that the greatest pressure necessary to be given throughout the week is on Sunday morning. I think of this on winter Sundays, when I patiently (and shiveringly) wait until nightfall for the works to put the pressure on.

Under such circumstances, I feel that Mr. Newbigging's forgiveness will be granted if I venture to hope for that "Golden Rule" to be returned to the refining furnace of his great experience, that another may issue therefrom alike worthy of himself and of the altered times.

CHARLES CARPENTER.

South Metropolitan Gas Company, July 13, 1907.

Unaccounted-for Gas and the Consumers' Meters.

SIR,—As I always appreciate anything from the pen of my old friend Mr. Norton H. Humphrys, I at once turned to the article appearing under his name in your issue of the 9th inst. I confess, however, there were some things in his contribution which rather staggered me.

While most engineers will agree that the "Sales of Gas Act" stands in need of amendment in some particulars, yet surely it would be most unwise to seek to have the percentage of error in favour of the consumer struck out. Such a change would never be sanctioned, and the mere mention of it would raise a hornets' nest about our ears. I think that, for one thing, greater facilities ought to be given for having meters officially tested; for, so far as Ireland is concerned, there is only one testing-station—in Dublin. The conditions of testing, also, ought certainly to be amended in conformity with modern practices; and the testing of meters for accuracy of measurement, and measuring capacity per hour, should not be specified at 5-10ths pressure.

I fear, however, that this question of unregistered gas looms so large in Mr. Humphrys' perspective, that he has been led into quite an extravagant idea of its importance. I was brought up to believe in wet meters. My father (formerly Engineer of the Perth Gas-Works) was a wet-meter advocate, and, naturally, I imbibed the prejudice against dry meters. Though they have their advantages, are much sought after by consumers, and are undoubtedly more reliable than they were thirty or forty years ago, I must confess to being suspicious of them still. I always feel, when a dispute arises, that I am on sure ground when a duly stamped wet meter is the subject of dispute; but, in the case of a dry meter, I never feel happy till I know the result of the test. I remember when my father was driven by circumstances to get any dry meters, he used to stipulate that they should register correctly when passing half-a-cubic foot per hour; and I have had them similarly tested myself. Perhaps if some such test as this were stipulated in the Act, it would lay the ghost of this unregistered gas.

When one considers the method adopted in testing a meter, it is evident that any unregistered gas must be included in the percentage "slow;" and there is no need for a dry meter being issued registering "slow" at all. Of course, the case is rather different with wet meters. Although, with the fountain meter or the Warner and Cowan drum, there is no necessity for "slow" registration if the watering be properly attended to, and certainly, unless the water used has the effect of rapidly "pitting" the drum, wet meters should be a very long time in use before they will pass unregistered gas. The modern condition of practically equal pressures during the twenty-four hours removes a source of error formerly almost unavoidable when day gas was invariably measured on a low-water line and night gas on a high.

In conclusion, surely Mr. Humphrys has fallen into some unaccountable error in connection with the illustration he uses. A 10-light meter would not be tested for accuracy of registration by passing 60 cubic feet through it, but by passing 5, or most probably 10, cubic feet through it in as many minutes. Now, if 2 cubic feet unregistered in the soundness test (surely an extreme supposition) would become about 1 foot per hour at 5-10ths pressure, then the unregistered gas would be one-sixth of a foot on 10 feet, equal to 1·66 per cent., which would certainly not be a negligible quantity, and would more than half exhaust the 3 per cent. against the seller allowed by the Act. Then, supposing it were absolutely correct but for the unregistered gas, the quantity lost, in the hypothetical case stated, would be 833 cubic feet, not 17,000 cubic feet. How the 17,000 cubic feet is arrived at, I cannot understand. A few such meters registering less than two-thirds of the gas passed through them would soon swell our leakage account.

Armagh, July 12, 1907. JAS. WHIMSTER.

The Distribution of Gas.

SIR,—Please allow me to thank you for the extremely considerate and generous review you gave my book, on "Distribution of Gas," in your issue of the 18th ult. I quite agree with some of your criticisms and suggestions, and hope to profit by them if, and when, a second edition is required. I was especially pleased to note that you appreciated my strong desire, when availing myself of the previous work of others, to give full acknowledgment of sources of information. Anything in the nature of plagiarism is particularly hateful to me. At the same time it is very difficult for a student of his profession, and a diligent reader of the Technical Press for a period of twenty years, to know where personal experience and observation end and indebtedness to others commences. However, I am glad to know that in this matter I have been so far successful as to win your approbation.

Again thanking you, and apologizing for the somewhat belated character of this letter, for which the holiday season is partly responsible.

Leeds, July 12, 1907. WALTER HOLE.

Mr. Tooms's Gas Institution Paper.

SIR,—As you had a long letter from Mr. Tooms in your last issue, I think it necessary to reply.

In his paper, he contended that the increase in consumption of gas depends in a far greater degree on outdoor service reudered to consumers than it does on the price per 1000 cubic feet at which gas is sold. Throughout the paper this contention is laboured to the utmost, but not in any way proved; and there is not one allusion from beginning to end to the advantages both to undertakers and consumers of selling gas at a moderate price. In my letter, I have shown the very strong determining influence that price has on the sale of gas; and this I have proved from the figures given in Table I. of the paper alluded to. Take the extremes of the towns in Table I., mentioned in the letter. Waterford, at the price of 3s. 9d., has a make of 3033 cubic feet per head; while Mallow, with a price of 5s. 8d., has a make per head of only 1168 cubic feet. I have also drawn attention to the difference between Mallow and Middleton. Middleton, with a price of 4s. 7d., has a make of 1725 cubic feet per head; and Mallow, with a price of 5s. 8d., has a make per head of only 1168 cubic feet. He now admits that price has a strong influence on increasing the consumption of gas, because he cannot dispute it. This is my case—fully proved and admitted.

I might stop here, only I think it right to notice, as briefly as possible, some other statements Mr. Tooms has made. Taking, again, his own figures relating to Waterford and Wexford, as appearing in your issue of the 9th inst., Waterford, with a make of 65 million cubic feet of gas in 1900, had a make per head of only 2428 cubic feet—about the same as the small town of Tipperary at present—while Wexford had a make of 3223 cubic feet per head. Now, Waterford practically has been under the same management for fifty years, more or less. I am perhaps inclined to follow a bad example by assuming things too freely; but judging from these figures, it would not be unreasonable to assume that Waterford was asleep until 1900. It has no doubt done a good deal to make up the leeway since then. It is somewhat hard work to sell a dear article to a rather unwilling purchaser. In spite of all the pushing and all the devices that have been put in practice to increase consumption, it is still below Wexford in that respect—and this notwithstanding that, according to Mr. Tooms's statement, what has been accomplished in Wexford has been achieved without effort. If the price of gas has a strong influence on determining consumption, so also has population; and it would be easy to prove that the more populous a town is, the greater the consumption per head, and the greater the advantage to the gas undertaking and to the consumers in every way. This is a rule to which there are but few exceptions. Waterford has a population of 27,769, against 11,168 in Wexford. The former is a county borough, and a most important shipping port—coming very near to Cork in this respect. It is an important trade centre, supplying the counties of Waterford, Tipperary, Kilkenny, and to some extent Wexford, largely with goods. All these counties converge on it. This is a statement which cannot be disputed. Mr. Tooms said that Wexford has "huge engineering shops." It will be seen from the fact that these "huge engineering shops" use in a year, for all purposes, a total of only 1,346,000 cubic feet of gas, how little they add to the consumption. Business establishments and private houses using gas for lighting, heating, and cooking, consume by far the largest proportion. It has been coolly assumed, among other things, that there are no cookers here.

The few persons who take the trouble to read these letters, will see, and readily admit, that the consumption of gas per head of the population should be very much larger in Waterford than in Wexford. It is not fair to compare the consumption of Cork per head with that of Dublin, as Dublin, besides having a very large population, is the Metropolis of Ireland. Bangor, for a small town, has (much to its credit) a very large consumption per head, and holds an exceptionally good position in this respect among all other Irish towns. Most of the places in the North of Ireland are manufacturing towns to a larger extent than Wexford. Whether Bangor is, or is not, I am not in a position to say. Except Belfast, Bangor, Omagh, Newry (which beats it by 99 feet per head), and Armagh (by only 1 foot), Wexford has a higher consumption per head than any other town or city in Ireland, as far as I can ascertain. I mention this, in no boastful spirit, but only to show that we have not been altogether asleep in Wexford, and to prove—if any further proof be wanting—the good effect of supplying gas at a reasonable price. I firmly believe that all the gas managers of Ireland are doing excellent work—some under great difficulties; and it is certain all the foresight and care are not confined to the Waterford magic circle.

From what I have already written, I consider that I can afford to take with good humour the rather disparaging remarks which Mr. Tooms has thought fit to make about me. I regret to notice that he appears to have lost his temper and forgotten his politeness to some extent; and as he has kindly offered his advice, I would give him some in return. It is, that he should be very careful in making assumptions; that he should only make statements when he is in a position to prove them; and that he and all concerned who are selling gas at high prices should look carefully ahead lest they may find, in the near future, that they are resting on shaky foundations.

Wexford, July 10, 1907. JOHN LYNE.

Alleged Fire Risks of Incandescent Gas Lighting.

SIR,—I notice in Mr. Copp's very able and interesting paper on "Incandescent Gas Lighting, with Special Reference to Inverted Burners," read before the Dublin meeting of the Institution of Gas Engineers, he quotes a statement made by Mr. Victor A. Rettich, in a paper read in March, 1906, before the Illuminating Engineering Society in this city, in which he asserted "that inverted burners were unsuccessful in the city, and that Fire Insurance Companies demanded higher premiums for buildings in which they were used, on account of the dropping of particles of incandescent carbon."

Mr. Rettich probably confused a ruling of the Board of Underwriters (which represents all Fire Insurance Companies doing business here, and before which all such matters come) concerning "gas arcs" with the subject of inverted burners. In any event, no such ruling or demand for higher premiums has ever been made, and no restriction whatever has ever been placed upon the use of inverted burners by the Board of Underwriters or the Fire Insurance Companies doing business in this city—in fact, upon investigation, I learned that the matter had never even been called to their attention.

New York, July 1, 1907. GEO. G. RAMSDELL.

Adjustment of Gas Supply to Inverted Burners.

SIR,—With reference to the article entitled "The Adjustment of the Gas Supply to Inverted Gas-Burners," which appeared in your issue of July 2 (page 20), we think this does not altogether deal fairly with us in the matter. At the Dublin meeting of the Institution of Gas Engineers, Mr. Harold E. Copp announced his preference for dispensing, as far as possible, with the use of mechanical adjusters; and, in the discussion which arose, Mr. W. R. Herring averred that his experience was exactly the opposite. On being asked what burner it was that enabled him to arrive at this conclusion, he distinctly stated it to be the "Bland." The article referred to deals exclusively with the new "Nico" adjuster; and as Mr. Herring's name is used by way of introduction, we think that, in justice to ourselves, it should be made clear that the adjuster which inspired the article, and upon which Mr. Herring was enabled to justify his remarks, was the one which for some time past has been attached to the "Bland" Burner, and which to a great extent has made it such a popular and satisfactory one.

63, *Queen Victoria Street, E.C., July* 12, 1907. BLAND AND CO.

Medical Examinations of Employees.—The Home Secretary has made the following regulations as to examinations of a workman by a medical practitioner provided and paid by the employer under the provisions of the First Schedule to the Workmen's Compensation Act, 1906: (1) Where a workman has given notice of an accident or is in receipt of weekly payments under the Act, he shall not be required to submit himself, against his will, for examination by a medical practitioner provided by the employer except at reasonable hours. (2) A workman in receipt of weekly payments shall not be required, after a period of one month has elapsed from the date on which the first payment of compensation was made, or, if the first payment is made in obedience to the award of a committee or arbitrator, from the date of the award, to submit himself, against his will, for examination by a medical practitioner provided by the employer except at the following intervals: Once a week during the second, and once a month during the third, fourth, fifth, and sixth months, after the date of the first payment or the award as the case may be, and thereafter once in every two months. It is provided that where after the second month an application has been made to the Court or to a Committee for a review of the weekly payment, the workman may be required, pending and for the purposes of the settlement of the application, to submit himself to one additional examination.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills reported, with amendments: King's Norton and Northfield Urban District Council Bill, Kingston-upon-Hull Corporation Bill, Worthing Gas Bill.

Bills read the third time and passed: Gas and Water Orders Confirmation Bill (No. 2), Leeds Corporation Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bill brought from the Lords, read the first time, and referred to the Examiners: Gas and Water Orders Confirmation Bill (No. 2).

Lords Bill read a second time and committed: Colne Valley Water Bill.

Lords Bills reported, with amendments: Gas and Water Orders Confirmation Bill (No. 1), Great Yarmouth Water-Works and Lowestoft Water and Gas Bill, Tynemouth Corporation (Water) Bill.

Lords Bills read the third time and passed: Gas and Water Orders Confirmation Bill (No. 1), Heywood and Middleton Water Board Bill, Pontypridd Urban District Council Bill, Wisbech Water Bill.

The Birkenhead Corporation Water Bill, Colne Valley Water Bill, and Portishead District Water Bill [Lords Bills] have been referred to a Select Committee, consisting of Mr. Arthur Stanley (Chairman), Mr. Gooch, Mr. Pearson, and Mr. Haworth; to meet on Thursday.

GREAT YARMOUTH WATER-WORKS AND LOWESTOFT WATER AND GAS BILL.

House of Commons Committee.—Tuesday, June 25.

(*Before Sir* Joseph Leese, *Chairman*, *Viscount* Turnour, *Sir* Walter Nugent, *and Mr.* Clough.)

This Bill, which is to authorize the promoters (the Great Yarmouth Water Company and the Lowestoft Water and Gas Company) to take an additional supply of water from the River Bure, came before the Committee to-day. It had been considered by a Select Committee of the Upper House, who passed the preamble on April 26.

Mr. Balfour Browne, K.C., Mr. Honoratus Lloyd, K.C., and Mr. Holman Gregory appeared for the promoters (Messrs. Sherwood and Co. being the Parliamentary Agents); Mr. Moon, K.C., and Mr. Vesey Knox, K.C., represented the Great Yarmouth Corporation, who opposed the Bill, and Mr. Tyldesley Jones attended on behalf of the Great Yarmouth Port and Haven Commissioners (Messrs. Sharpe and Co. being the Parliamentary Agents for both bodies).

Mr. Balfour Browne, in opening the case, said the Bill was promoted for the purpose of authorizing the Great Yarmouth Water Company and the Lowestoft Water and Gas Company to take an additional supply of water from the River Bure, in the parish of Horning. Both Companies were near the end of their tether in regard to water; and they had entered into a joint scheme for the purpose of getting a supply for their two towns. A similar Bill was introduced last year, and passed the House of Lords, but was rejected in the House of Commons—not, however, by a unanimous Committee. This year, having failed to find any other source of supply, they came again to Parliament. Throughout they had had practically only one opponent—the Corporation of Great Yarmouth, who opposed on the ground that the water taken from the River Bure was not proper water for the supply of a town. But he ventured to say that he would be able to convince the Committee, as that of the other House had been convinced, that the water the promoters would supply to Great Yarmouth would be perfectly satisfactory. The raw water in the River Bure—before it was treated at all—was a great deal better than the Thames water with which London was supplied. The gathering-ground extended over 111,104 acres; and it was very sparsely populated. On the whole of this area, there was only one person to every four acres; so that this was not very serious. The Great Yarmouth Company were incorporated in 1853, and had several Acts of Parliament. Their works were at Ormesby. The supply area had been extended from time to time since 1853. They had supplied constantly to their district water which was admitted to be of excellent quality; and there was no allegation in the petition of Great Yarmouth that the present supply was bad. This was a very important feature. Great Yarmouth practically admitted that the Ormesby Broad water was good. The Lowestoft Company were also incorporated in 1853, and had various Acts of Parliament. They obtained their water in the parish of Lound, about six miles from Lowestoft. The population of the town was 30,000, and of Great Yarmouth 52,000. The number of visitors and trippers to the towns was, however, very great indeed, demanding a large supply of water when the towns were full of people. There was a growing demand for water; and the Companies had laid additional pumping mains to the Broads, on which they depended to fill their reservoirs, which had a top-water area of 350 acres. The water varied much in certain seasons; and there was constant fear of a prolonged drought. There were three principal points raised by the petitioners against the Bill. In the first place, they said the water would be polluted by the people who drained into the stream above the point of intake. When the Bill was before the other House, the Chairman said the Committee did not consider that the river, having regard especially to its being a holiday district, was more polluted than any other from the Channel to the Tweed. However, the promoters thought, with a view to safety, they would not draw any water from the Bure during the month of August; but, after hearing evidence, the Committee of the other House said that this time was to be extended, and that they were not to take water from the 15th of July down to the end of August. With regard to sedimentation, last year they did not propose to have any reservoir for this purpose, or for allowing the water to part with its solid matter in suspension. But, on the representation of the Great Yarmouth people, a sedimentation clause was introduced into the present Bill, which put upon the promoters the obligation to have a subsiding reservoir. With regard to the Muckfleet Commissioners, since the Bill was in the other House the promoters had been in communication with them for the purpose of keeping up the water of the Ormesby Broad. This would not give them any new source of supply, but would help to maintain their present source. The petitioners raised three points—one being the pollution from places higher up. The promoters had gone very carefully over the district, and they did not believe that any pollution would get into the stream to make the water unsatisfactory. Beyond this, they were very careful as to the powers they were applying for in regard to this matter—viz., those contained in the Rivers Pollution Prevention Act, which would enable them to prevent any pollution of the Bure above their source of intake. They were also asking for power to agree with the owners of property to divert any pollution, and bear the expense. A second point raised was the pollution from boats upon the Bure. He believed there were only 100 boats on the river that were fitted with what were called water-closets; and it could be shown that the people at Stokesby and Horning on the river habitually drank the water without any harm resulting. But the petitioners said the water of Ormesby Broad was all right; and they suggested that more use ought to be made of it. There were some 107 pleasure-boats on Ormesby Broad; yet there it was said the water was satisfactory. A third point raised was that the sewage of Great Yarmouth might be carried up the stream. The town was 21 miles from the proposed intake; but the petitioners said that on certain occasions, when there was a very high tide in the German Ocean, the water of the Bure and of other streams could be backed down and the water might become to some extent saline. In order to avoid drawing when the sea came up, the promoters were prohibited, under the Bill, from taking water when there were more than 20 grains of chlorine per gallon in it. In conclusion, the learned Counsel said there was an urgent necessity for water; and there was no possibility of getting it from any other place than the one selected. They had no interest in taking the water of the Bure if they could get any that was better. But they wanted to get it in the cheapest and best possible way; for the cheaper they got it, the cheaper it could be supplied.

The following evidence was then given.

Mr. *Charles Hawksley*, examined by Mr. Honoratus Lloyd, said the population within the limits of the supply of the Great Yarmouth Company, according to the census returns, was 49,225 persons in the year 1881, and 54,389 in the year 1901. This was the resident population; but, in addition, there was a very large floating population. There had consequently been an increase in the quantity of water consumed per head; and the Yarmouth Company were in need of an additional supply. They were now short of water; and at any time it might be drawn down by the Muckfleet Commissioners, who had control of the Broads from which the water was taken. Though they had hitherto managed to pull through, it had, in dry times, only been by a great struggle. The scheme before the Committee was a good one to be adopted; indeed, it was the best one available. He thought it was a proper scheme for the supply of Yarmouth and Lowestoft, having regard to all the circumstances of the case and the great difficulty of getting water; in fact, he did not know what the promoting Companies were to do if they failed to obtain the sanction of Parliament to the present proposal.

Wednesday, June 26.

In answer to Mr. Holman Gregory, witness said he had personally examined the banks of the Bure for many miles, and had come to the conclusion some time ago that the river was pure enough for its water to be used for domestic purposes. The Bill introduced last year was for taking water from the Bure and subjecting it to proper filtration, which, in his opinion, would have safeguarded it. It was now proposed to pump the water from the river, carry it to the sedimentation tank at Ormesby, and keep it there for a maximum period of seven days; then it was to be filtered in the same way as the Ormesby water. To complete the works proposed, would take, he thought, two years. During this period there would be time for the removal of the principal sources of pollution.

Replying to questions by the Chairman, witness explained his proposals in detail, and concluded by pointing out that after the water left the subsiding-tank it would go through two filters in succession, and then be mixed with the water from the Ormesby Broad; and he said he believed it would be perfectly fit for domestic purposes.

Mr. *A. E. Collins*, the Engineer to the Corporation of Norwich, examined by Mr. Holman Gregory, said he had made a careful examination of the Bure, and had found that the ordinary spring tides had very little effect upon the river at a point about 1½ miles below the proposed intake; and he had arrived at the conclusion that, under ordinary circumstances, sea water rarely found its way up the river so far as Acle Bridge, which was about eight miles below the intake. Consequently, he thought that, under ordinary conditions, Yarmouth sewage would not go up within eight miles of the spot. Under exceptional circumstances, it was possible for salt water to get as far up, and even a little farther; but he did not think it occurred once a year on an average. To his mind, either before the 15th of July or after the end of August, there would be no serious risk of contamination from boats or yachts. The volume of water running down the Bure was very large—not less than 40 million gallons a day.

In answer to the Chairman, witness said he had used Bure water without it being subjected to sedimentation, filtration, or any other treatment. He had simply taken it out of the river and drunk it.

Dr. *J. A. Gordon* said while he was a member of the Norfolk County

Council the River Bure had never, so far as he knew, come under the notice of the Sanitary Committee. As a doctor and District Medical Officer, he should say there was no serious risk of pollution from boats, outside the close time the promoters had proposed. The amount of dilution was so very great that the risk was infinitesimal.

Mr. *G. R. Strachan*, expressed the opinion that, with proper treatment, the water of the Bure was a safe one for domestic purposes. He said there was a reservoir, holding nine days' supply, which was always full; and it was a true sedimentation reservoir. This had a wonderful influence in purifying the water, if it needed purification; and there was efficient filtration following it. He had no doubt that the water taken from the Bure under the Bill would be excellent; and he would never hesitate to drink it.

Thursday, June 27.

Mr. *Otto Hehner* said he had examined the water at Great Yarmouth since 1900. He had inspected the River Bure, both below and above the proposed intake; and, in his opinion, the river was perfectly well fitted for supplying water for drinking purposes. A few gallons of drainage from a manure heap would bring into the river millions of *bacillis coli*, which, on being detected by the bacteriologist, might at once lead to the inference of dangerous pollution; whereas in reality, in his opinion, they meant absolutely nothing from a sanitary point of view. He had found on some occasions that the crude Bure water was better than filtered Thames water. The Bure water organically —that was to say, as regarded the dead dissolved organic matter—was considerably purer than the Ormesby Broad water. Bacteriologically, the Bure water was not better, but, on the contrary, worse, than the Ormesby Broad water, which had had the advantage of the lengthy settlement which the Bure water had not had. Chemically, however, the Bure water was better. The precautions taken with regard to any possible pollution which might come up, and which would be infinitesimal, would be quite satisfactory, so far as health was concerned; and the pollution would be inappreciable to the taste.

In cross-examination by Mr. Moon, witness said the more lively the river was—that was to say, the more organisms it contained—the more quickly they went. In the strife between the non-pathogenic and the pathogenic organisms, the latter were overwhelmed and vanished. Subject to the careful treatment to which the water was afterwards submitted at the hands of a water company, there was no danger. If they kept river water, no matter how much it was polluted, for a sufficient length of time, it would, in a sense, become perfectly safe to drink; but it would not be fit, because people revolted at drinking anything which was turbid or contained foreign particles. He did not suggest that seven days was long enough to make the water quite safe without filtration; it would have to stand much longer.

Dr. *J. C. Thresh*, the Medical Officer of Health for Essex, said he had been up the River Bure from the point of intake for twelve or fourteen miles, and had carefully examined the banks and the different houses and places all the way up. In his opinion, all the sources of contamination could be speedily removed so soon as it became the interest of any company or person to have this done. He thought the fact that the promoters were providing from seven to nine days' sedimentation, and that afterwards there would be filtration, would make the Bure water as safe as it was possible by human agency to make it. Chemically, the water contained a little excess of vegetable matter; but this was absolutely harmless. Except at the time when the water had been affected by salt coming up the river, it was perfectly satisfactory chemically. From a bacteriological point of view, it compared very favourably with that of other streams used for drinking purposes. Assuming that the water was stored for a short time, during which they got sedimentation and self-purification, and that then it was submitted to filtration such as was carried on at the water-works at the present time —which he might say were among the most efficiently managed that he had seen—he was perfectly convinced that it would be a safe water for the supply of Yarmouth and Lowestoft, or for the supply of any other place.

In answer to questions by the Committee, witness said, as a Medical Officer of Health, that after sedimentation and filtration he would pronounce the water to be pure, and entirely satisfactory from a sanitary and health point of view.

Mr. *W. L. Sutton*, the Public Analyst for the County of Suffolk, and Mr. *G. M. Taylor*, M.Inst.C.E., also gave evidence for the Bill.

Friday, June 28.

This morning evidence was given on behalf of the opponents.

Dr. *H. W. Beach*, the Medical Officer of Health for the borough and port of Great Yarmouth, said, from his experience, he was firmly of opinion that the proposed source of supply was not a fit one, because of the pollution of the Bure from the various sources that had been mentioned to the Committee. During the past eighteen months, he had made numerous inspections of the watershed, especially the portion of it which was in the neighbourhood of the proposed intake. The river ran by the side of the Broads, which were its feeders. It was not a river flowing through the centre of the Broads.

Witness described in detail what he considered to be the various sources of pollution.

Tuesday, July 2.

Dr. *H. W. Beach* was recalled this morning, and, in answer to Mr. Vesey Knox, said he regarded the danger from the boats on the Bure as a very serious one. Asked if he considered it possible to prevent the pollution of the river from the boats, he said it was not, unless they reconstructed the boats. The conditions were quite different from those on the Thames. As to pollution by tidal waters, witness made some special observations in February last, when there was a high tide. On Feb. 21 he went to Horning Ferry, which was above the intake, and took frequent samples of water from the river and analyzed them on the spot, with the result that he found that the salt water had reached that point some time before he arrived, and the chlorine contained steadily rose. At 3.15 p.m., when the first sample was taken, it was 25 parts per 100,000; at 6.30 p.m., it was 112 parts; at 9.30 p.m., it was 395 parts; and at 11 p.m., 202·5 parts. These samples were taken 1¼ miles above the intake. As a Medical Officer of Health, he considered that the sea water was a real danger. If they got it (say) within 12 hours from the Yarmouth Haven, there must be a danger of impurity getting up to the intake. There were more than 5000 men employed on fishing-boats during the autumn, and the serious point was that upwards of 3000 of them lived on their boats.

The Chairman: Your point is that where salt water goes the refuse from the boats goes with it.

Mr. Vesey Knox said that was so.

Mr. Balfour Browne: We made analyses of the salt water for organic matter, and found no increase.

Mr. Vesey Knox (to witness): Supposing bacteria of a harmful kind came up with the water, would it follow that they would go down again with it, or might they not be left in the water or in the mud near the point of intake?

Witness: They might be left in the mud, and the mud is frequently disturbed by the passing of steamers and launches. It would be a dangerous source of pollution if a number of bacteria came up and were deposited and stirred up again.

In cross-examination by Mr. Honoratus Lloyd, witness said he thought the Rivers Pollution Act was worthless for the protection of a drinking water supply. There was a fairly good sedimentation area, if the Broads were included; but the main stream of the river was quite clear of them. The water simply flowed in and then out again. There was no sedimentation area available at all between Horning Ferry and the intake.

The Chairman (to witness): Supposing all the sources of pollution of which you speak were in full vigour, and doing their very worst, would you say that the provisions of this Bill which have been put before us, by which the parties can make agreements, or, failing agreements, put the Rivers Pollution Prevention Act into force, would be insufficient, because the Act gives great powers?

Witness replied that they would. He added that, by considerable expense, which he should have thought prohibitive, the water of the Bure might be made pure. If they got rid of all the pollution, of course, the river would be pure.

Wednesday, July 3.

Mr. *J. W. Cockrill*, the Borough Surveyor of Great Yarmouth, said he had never, until he went to the Committee-rooms, heard of anyone drinking water from the Bure.

Mr. Clough: If Yarmouth were to get a water supply from the Bure, would the Corporation, for their own sake, always vigorously restrict the output of the sewage to the ebb of the tide for the whole 365 days of the year?

Witness: That would mean, on some four or five occasions, low districts being flooded with sewage. [Witness explained the method of getting rid of the sewage.]

The Chairman (to witness): Here are the Corporation of Yarmouth opposing this Water Company, and one of the reasons given for the opposition is that the intake is at such a spot that the salt water at high tide carries with it sewage, and makes it impossible to draw water from that place because of the sewage in it. You do not quite carry that out. You intimate that it is not a very serious matter. If it is, another alternative is presented?

Witness: It is a serious matter bacteriologically.

The other alternative is that here a Corporation are hiding behind their own wrong, or something very like it. That is the alternative—that you are creating a nuisance, and that you are using that creation of a nuisance in your own defence. That is how it presents itself to my mind for the moment. Is not there an obligation on the part of the Corporation of Yarmouth to do something to prevent that? How do other towns act under similar circumstances of high tides?—There are very few towns so favourably situated as we are for getting rid of their sewage.

Supposing it is the fact that nobody drinks this water up the River Bure, do you put that forward as an argument for making it quite impossible for anybody to drink it?—There is no demand for the water below the intake to be drunk at all.

Sir *Thomas Stevenson*, the Analyst to the Home Office, examined by Mr. Moon, said for the last nine years he had been acquainted with the water supply of Great Yarmouth. Under present conditions, there was not much to be found fault with, from a pathogenic point of view. A good deal had been done to the Ormesby Broad since 1899 to preserve its purity. With regard to the River Bure, he had seen in several places direct communication between sources of contamination and the river, especially at Horning Ferry. Witness then went into details in regard to the sources of contamination.

In answer to Mr. Honoratus Lloyd, witness said the chemical analysis he had made of the Bure water did not show that it was better than the Ormesby water; but it contained less organic matter. From analyses he had seen of the Ormesby water, it was not good; but he thought it was as good as they would probably get from any of the Broads. With three weeks' sedimentation of the Bure water, and double filtration, he thought it would be an immense advantage. He did not consider seven days would be sufficient. He attached a good deal of importance to the double process of sedimentation followed by double filtration. These processes were the utmost safeguard. At the same time, he considered that a water ought not to be taken that contained raw sewage.

Dr. *E. E. Klein*, Lecturer on Advanced Bacteriology at St. Bartholomew's Hospital Medical School, said he visited the River Bure last summer, and had been again recently. Having regard to the condition which to his mind was necessary for the prevention of actual pollution, and to the supervision of the sources liable to cause pollution, he did not think there was a trace of that condition having been complied with. Looking at the sources of pollution which he saw, he did not consider that the water was fit to be taken for a public supply. He had seen the principal sources of pollution which had been spoken of. Then there was the river traffic of wherries, and so on. This he regarded as of greater moment, because they could not deal with it. He also attached considerable importance to the question of mud; and at some parts of the river the water looked very muddy.

Thursday, July 4.

Dr. *G. F. Deacon* said he had carefully examined the provisions of the Bill, the present supply of the Water Company, and the proposals made. Ormesby Broad formed a natural subsiding reservoir of a most efficient kind. He calculated the storage available for subsidence, taken upon the 5-feet depth, and the volume of water supplied to Yarmouth last year worked out to almost exactly 200 days' storage.

Mr. VESEY KNOX: Do you think it is possible, at any reasonable cost, to make the danger of animal pollution on the Bure as little as it is at Ormesby Broad.

Witness: No. In the first place, the crude water is very much worse. I do not like the word "worse," because it may be interpreted in different senses; but the danger from the crude water is very much greater on the Bure than on the Ormesby Broad. Supposing it were the same, in order to give it the same freedom from danger, you would have to make a depositing-tank as effective as the Ormesby Broad. I do not think any arrangements that have hitherto been made, when applied to the Bure, would prevent crude sewage from getting into the river. In answer to further questions, witness said the density of pollution in the case of the Bure was nearly twice as great as in that of the Thames. He did not think the crude water of the Bure could ever be made quite as good as the Thames crude water, because the density of the population was greater per unit of water; and this was the difficulty. If there were no alternative scheme, he should say that the Bure water would have to be made fit for drinking, and that the greatest possible precautions must be taken; but as there was an alternative scheme, he would say the water ought not to be taken. He felt this very strongly. Whether or not the risk would be entirely removed, he thought was problematical.

Mr. *H. R. Mill*, the President of the Royal Meteorological Society, having given evidence,

Mr. ERNEST MOON addressed the Committee on behalf of the Corporation of Yarmouth. He said the purpose of the Bill was, to a large extent, to substitute for the existing supply of Yarmouth a fresh one. With the present supply Yarmouth was contented, for the reason that there was no practical risk attached to it, because there were no sources of contamination within a very long distance from the point where the intake of the Water Company was. But there was also this further protection—that not only were there no houses within anything but a considerable distance by water of the Ormesby Broad, but there were also no residential pleasure-boats upon it; this Broad not being one to which these boats could go. The greatest safeguard of all was the fact that before the water which came into the Broad could get to the intake, it had to flow for a considerable distance, the result of which was that they had the safeguard of sedimentation exercised upon the water for a prolonged period.

Tuesday, July 9.

Mr. BALFOUR BROWNE, on behalf of the promoters, pointed out that Mr. Moon had said that the Corporation were content with the present supply from Ormesby Broad. He had also said that there were no boats upon the Broad; but that was a mistake, because, though there were no wherries and no pleasure boats such as were upon the other Broads, there were 107 boats which were let out for hire upon the Broad, and from which, of course, pollution might find its way into the Ormesby Broad. Mr. Moon had said that Great Yarmouth were advised that there was some risk in taking this water. He (Mr. Balfour Browne) ventured to say that though Great Yarmouth was a pleasure resort for a large number of people at certain times, it was no more a pleasure resort than Lowestoft. Mr. Moon had said that Lowestoft must not be claimed as in favour, because it was neutral. Now, a corporation of a town had no right to be neutral if they thought that a water unfit for domestic use was going to be supplied to them. It would be a gross dereliction of duty; and therefore he (Mr. Balfour Browne) did claim that Lowestoft having had the full advantage of hearing the case discussed now on three separate occasions before the present (this was the fourth), had advisedly remained away, and did not object to having their water supply from the Bure. Not only that, but, as could be seen by the limits of supply both for Lowestoft and Great Yarmouth, the Company were supplying districts in the counties of Norfolk and Suffolk; and if this water were an impure supply, they were bound to come forward and protest against it. On the first occasion of coming to Parliament, the county of Norfolk did present a petition upon some minor point; but not one word was said either by Norfolk or Suffolk as to this water being an improper one. Mr. Moon had said that the Corporation of Great Yarmouth were able to take an impartial view. He (Mr. Balfour Browne) thought that, instead of being an impartial Corporation, there was a good deal of temper in their opposition. He submitted that there was no ground in fact why the water should not be supplied. Mr. Moon had also said—apparently with the view of crippling the Bill—that the seven days' sedimentation was quite inadequate. If the Company had sedimentation put upon them to anything like the time that Dr. Klein had said would be necessary—14 or 21 days—it would kill them. The Committee had had it in evidence that the two days that were put upon the Company in the other House, and which were thought expedient by Lord Ribblesdale's Committee, would cost £10,000 additional. Every day, therefore, was £5000 additional for sedimentation; and who was to pay the interest on such an outlay? The people of Yarmouth could not be charged any more than the water-rates; therefore the Company would have to go without a dividend.

The CHAIRMAN: You are raising an issue for the Committee as to whether it is better to protect the shareholders in their dividend or to protect the public.

Mr. BALFOUR BROWNE: No. I will deal with it in its order. I will show that this sedimentation is absolutely unnecessary. But what my learned friend says is "Whether it is necessary or not, put it upon them." If it were absolutely essential, I would not have a word to say. If you were to come to the conclusion that this water was not fit to be taken without sedimentation that would really take away all my dividend, I could not resist it. The public are the first people to be considered. I quite agree with that. In fact, the preamble is that the Bill is in the interests of the public; and that is what we have to prove. Continuing, Counsel said typhoid bacilli had not been proved to be in the Bure water at all. There had not been a single suggestion of it. Mr. Moon had said that the Yarmouth people had an alternative source. He (Mr. Balfour Browne) objected to this entirely. The Yarmouth people had been prevented from going to an alternative source; and yet Mr. Moon was asking the Committee to assume that there was an alternative source. There was no information as to there being an ample supply or an assured supply. He would ask the Committee to come to the conclusion that the River Bure was a perfectly safe source of supply for the people of Great Yarmouth. He admitted that there were one or two sources of pollution; but before they took the water, these would be got rid of. He pointed out that he was asking the Committee to give to the Company the powers of the Rivers Pollution Prevention Act. Mr. Moon's criticism was that the Act was not enough. But it was sufficient for every river in England with the exception of three—the Thames, the Mersey, and the Irwell. Beyond these, the Company were taking powers to enforce the Public Health Act, 1875, section 69 of which was to the following effect: "Any local authority, with the sanction of the Attorney-General, may, either in their own name or in the name of any other person, with the consent of such person take proceedings by indictment, bill in Chancery, action, or otherwise as they may deem advisable for the purpose of protecting any water course within their jurisdiction from pollutions arising from sewage either within or without their district, and the costs of, and incidental to, any such proceedings, including any costs that may be awarded to the defendant, shall be deemed to be expenses properly incurred by such authority in the execution of this Act." This power was only in the local authority; but by their Bill the Company were taking that power themselves. In the first place what the Company wanted to do was to put in force the Rivers Pollution Prevention Act, and if anybody was polluting the stream, to prevent it. But if, on the other hand, the landowner said: "I do not want to do it if you will be at the expense of removing this pollution for me," it would be for the Company then to put their hands into their own pockets rather than go to law and fight the matter. The water would not be taken until the pollutions were got rid of. Dr. Stevenson had said that with proper filtration the Bure water would be passable.

The CHAIRMAN, after a short adjournment, said the Committee had decided to regard the preamble of the Bill as proved, subject to certain amendments. The Committee suggested putting in Mr. Balfour Browne's proposed clause to remove all sources of pollution before taking any water from the River Bure. They proposed to amend clause 6 by making the capacity of the subsiding reservoir not less than nine times the maximum quantity of water, instead of seven times. With regard to clauses 29 and 30, the Committee thought the public would be more protected if they increased the 400 yards above the intake to one mile and left the 400 yards as it stood in the section below the intake. Therefore the Committee were agreed that this should be done.

After further discussion, the clauses were agreed to, subject to amendments; and the Bill, as amended, was ordered to be reported to the House.

Quality of Gas in South London.

At the meeting of the Camberwell Borough Council on the 12th ult., it was resolved, on the recommendation of the Works and General Purposes Committee, to send to the South Metropolitan Gas Company a copy of the report of Alderman Hearson on the subject of gas testing, which was submitted to the Council on the 17th of April, and noticed in the "JOURNAL" at the time. At the meeting of the Committee on Monday last week, they reported that they had received from the Secretary of the Company (Mr. Frank Bush) the following letter; "Your letter, enclosing report on gas testings by Alderman Hearson, and requesting the Company's observations on the same, has been considered by the Directors. In reply, I am instructed to say that the report contains many fallacies and inaccuracies, and is very unfair to the Company. For instance, the statement is made that the illuminating power and pressure 'are slightly in excess of the amounts prescribed by Parliament;' whereas the former averages over 16 candles, or 15 per cent. above the requirements (in effect giving 23s. worth of goods for £1, which is not a slight excess), while the pressure is everywhere and always at least double the amount prescribed. The report also attempts to reopen a question which has, after forty years of experiments, and repeated deliberation and exhaustive inquiries by the most competent tribunals, been authoritatively and finally settled. Under these circumstances, the Directors feel that the only observation to be made is that all the prescriptions of Parliament as to the supply of gas to the consumers have been honestly and liberally fulfilled. There is, however, one of the prescriptions of Parliament which has not been complied with. The shareholders have had to forego part of the very moderate dividend of about 4½ per cent. authorized by the sliding-scale, as explained in the circular issued to the consumers." In regard to the foregoing letter, Alderman Hearson had written to the Committee stating that the "fallacies and inaccuracies" instanced by the Secretary of the Company were too trivial to require reconsideration. He agreed that the pressure was ample for all purposes, and even greater than the Secretary had stated; but in view of the fact that the Company were doing all in their power to promote the use of incandescent burners for illuminating purposes, the 15 per cent. extra candle power was of no use to the consumer, unless it indicated greater calorific value. He did not, however, agree that the sulphur question had been authoritatively and finally settled. The Committee do not propose to take any further action beyond formally acknowledging the receipt of the Company's letter.

Referring to the tenders for gas coal, Mr. H. S. Timmis, the Chairman of the Widnes Gas Committee, said that, owing to the increase in prices, they had to face an extra expenditure of £4000. This would justify the Committee in raising the price of gas by 3d. or more per 1000 cubic feet. They believed, however, that they would be able to go on without increasing the charge.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Monday, July 8.

(*Before Mr. Justice* SWINFEN EADY.)

Attorney-General v. Rhymney and Aber Valleys Gas and Water Company.

On the resumption of the proceedings (*ante*, p. 111) this morning,

Dr. *W. R. Smith*, F.R.S., the Principal of the Royal Institute of Public Health, was called, and produced the analyses of 16 samples of water—three obtained in February, seven in September, and six in October, 1906; the last six having been taken under his own supervision. The analyses were made both chemically and bacteriologically. He also spoke to what he saw on his visit, and said he was quite prepared for the result of the analyses. The only place where there was any attempt at treatment of the water was at Aber. This was satisfactory, so far as it went. But there was only one filter-bed; so there was no provision for laying it off and cleansing it. Some of the analyses showed contamination from fæcal matter; while in others there was coal dust. The water was undoubtedly bad and unwholesome.

Cross-examined: One of the samples developed 24,000 colonies per cubic centimetre on gelatine plates, at 21° C. The sample bottles were not packed in ice. In the Llanbradach water there were *streptococci*; but no *bacterium coli communis* or *bacterium enteriditis*, which showed that the water was not properly looked after. Witness was taken at length through the various analyses, and said in several cases the figure for oxygen absorbed was so high, and also the albuminoid ammonia, that it raised grave suspicion. One could not go by a single factor alone in judging of a water.

In reply to his LORDSHIP, witness said this water could not, by any stretch of the imagination, be described as pure and wholesome. He could not conceive of anyone with an adequate knowledge of the subject so describing it. The samples taken by himself in October were undoubtedly the worst of all. The main requisite was filtration.

This concluded the plaintiffs' case.

Mr. MACNAGHTEN said his case was that the water was pure and wholesome within the meaning of the Act of Parliament. The district was a scattered one, and the Company only small; and they had been doing their best to overcome the difficulties with which they were met. These difficulties were increased by the fact that the two reservoirs of Pen Capel and Nant-y-Galch, which they purchased from the Council for £2500, proved utterly useless, and had to be abandoned. The Company had realized the danger arising from the farm above the Rhymney reservoir, and had taken a lease of the land from the Duke of Beaufort, and covenanted to remove the farm within two years from October last. Arrangements were being made for doing the same thing with the other farm higher up; and when this was done, and a system of filtration adopted, it was believed that a thoroughly good supply of water would be secured. Mr. Rees, the Company's Surveyor, had recently died; and his previous illness had interfered with the carrying out of the plans which had been formed for the proper fencing of the reservoirs and the filtration. The whole of the profits made had been employed in improving the works, instead of paying dividends; and it was the Company's intention to go on doing this. There had been no outbreak of disease which could be attributed to the water; and this was the best answer to the plaintiffs' case.

Mr. *E. K. Burstal*, the adviser to the defendants, said he had made a special inspection of the district for the purpose of the case. Arrangements had been made for removing all the farm buildings from the spot just above the second reservoir. He did not think filtration was required at the Deri reservoir, as it was fed from springs; at the other reservoirs, it was intended to put filters, in accordance with his recommendations, except at Senghenydd, which was also fed by a spring, and he did not think spring water was improved by filtration.

Cross-examined: With the exception of Deri, he recommended something being done at each of the reservoirs.

Sir *William Crookes* said he had made about 120,000 analyses of London water during his 25 years' experience as Examiner on behalf of the Water Companies. He had seen the analyses produced, and had also had some made of seven samples of water taken on the spot by his son on June 25 last. No. 1, from the Rhymney reservoir, was a very good sample of upland water. He judged mainly by the relation between organic carbon and nitrogen, which was about 10 to 1. It showed that there was no appreciable animal contamination. He should say it was perfectly pure and wholesome. There was no doubt the farm ought to be removed, as it was going to be; but, apart from sentimental reasons, it did no injury. Sample No. 2 was from Deri, and was an upland water of great purity. No. 3 was similar. No. 4 (Llanbradach) had all the characteristics of water from the millstone grit. It was of great organic purity. It was hard; but the hardness could be reduced by boiling. No. 5 was also an upland water of great purity. No. 6 was similar, but even better. No. 7, from Aber, was an upland surface water of medium purity; the organic matter being vegetable. He had also analyses of seven samples taken on the 19th of June, in which the bacteriological results were not bad for unfiltered water. The microbes were not in great numbers. Though the *bacillus coli* was found in several cases, this was not of itself injurious. It might be regarded as a danger-signal. He should certainly recommend that all these waters should be filtered. Witness was then questioned upon Dr. Smith's analyses, as to which he said he had little confidence in the albuminoid ammonia indication; and the carbon and nitrogen not being taken separately, he could not compare the figures with his own. He was not accustomed to test for bacteria at so high a temperature as 21° C., nor for three days; and he did not attach importance to the bacteriological examination of water, unless the sample had been very carefully taken in a hermetically sealed tube, and packed in ice for transport. He saw nothing in the reports, considering the source from which the water came, to show that it was not pure and wholesome. There was nothing serious about the coal dust. It would be removed by filtration, which, of course, should be done. He had ceased for a long time to search for *streptococci*, as it was very troublesome, and led to no definite results. He objected to the use of the words "sewage organisms" in Dr. Smith's report, because sewage meant in this connection human sewage, and there was no proof of this being the case. He should say all the waters were pure and wholesome.

Cross-examined: As a chemist and bacteriologist, he could not say that any one of the waters was perfectly pure and wholesome on the analysis alone; but if the water came from a good gathering-ground, with no possible contamination from sewage, he should say that it was pure and wholesome. If the water came from a river, he should say it required looking into. It was of paramount importance to know the nature and character of the supply. Of these matters he had no personal knowledge in this case. He had read Dr. Watson's evidence; but, looking to the size of the reservoir, he did not consider it of any importance. He should not like to drink the water; but he should say it was perfectly pure and wholesome. Of course, the reservoirs should be protected, and filtration adopted. Witness was cross-examined at great length; but his evidence was all to the same effect—that analysis alone was not a sufficient guide in judging of water; it was necessary to look at the source and the surroundings. He admitted that the test by comparing the amount of carbon and nitrogen had been discarded. It was difficult of application, and without very great care was open to serious experimental error. There was no doubt that the samples of water taken in June were more dilute than those taken the previous October.

Mr. *H. Crookes* put in a table of the samples he took on the 19th and 25th of June, and explained how he took them. He made the analyses himself. He saw no signs of human excreta round the reservoir at Rhymney when he was there. With regard to the samples taken, he confirmed his father's evidence, that all were pure and wholesome. Taking Dr. Smith's analyses, he should say that chemically the waters were of medium purity. He preferred not to say anything about the bacteriological results, because he did not consider the samples were taken and treated in a satisfactory manner.

Cross-examined: The Ystradmynach sample was as good as, or better than, either of the others. It was pure and wholesome; and he saw no reason to discontinue its use. He did not now look for *streptococci*; in the present case, he had not time. He admitted that this examination was important. He agreed with his father that one could not form an opinion worth having on analysis alone, without knowing the surroundings. If a water showed impurities above the recognized standards, he should condemn it on analysis alone; but in the present case this was not so. Filtration was always necessary.

Re-examined: It was essential for getting accurate results in bacteriological examination that the samples should be immediately packed in ice. He would not leave them for even three hours.

Tuesday, July 9.

The last witness called for the defendants was

Mr. *A. W. Branson*, who has held the position of Engineer and General Manager to the Company since April last, in succession to Mr. A. R. Cawley, who had retired. He said on his appointment he inspected the whole of the works, with a view to advising as to the adaptability of sand pressure filters to the Caerphilly district.

His LORDSHIP said this was immaterial evidence, as it referred to something after the issue of the writ. He accepted what had been said as to the defendants' intentions.

In further examination, witness described the works which were being carried on at the Rhymney reservoirs, and the present condition of affairs. He said there were about 25 men employed, and the huts were all empty but one. The men did not live on the spot, and he saw no signs of nuisance. The reservoir was full and overflowing.

Cross-examined: The work was being done by a contractor, and the Company did not exercise any control over his men. He had heard Mr. Watson's evidence, and looked for any indications of what had been described, but saw none. He did not notice whether or not any conveniences were provided for the use of the men.

Mr. AUSTEN-CARTMELL then addressed his Lordship on behalf of the defendants, and submitted that the charge made, of refusing to take proper steps to give the district a pure and wholesome supply of water, had not been established, and that the plaintiffs had unnecessarily rushed into litigation.

This closed the defendants' case.

Justice SWINFEN EADY, in giving judgment, said the question was substantially whether or not the defendants, down to the time of the issue of the writ, were giving to the plaintiffs a supply of pure and wholesome water, in accordance with their statutory obligations. There had been complaints from time to time, and in October last various samples of water were taken and submitted to the Royal Institute of Public Health; and detailed reports had been put in showing the results of the chemical analysis and bacteriological examination of the samples. Dr. Smith had confirmed the report made by him at the time, that all the samples (with one exception) were unfit for domestic use. On the other hand, samples were taken in the month of June last by Mr. Henry Crookes, and examined by him; and Sir William Crookes had given evidence with regard to them. It was not disputed that both sets of samples were fairly obtained. But those taken on behalf of the plaintiffs were obtained in October, after a hot and dry summer, while the others were taken in June, when there had been a good deal of rain, and the upper reservoirs were full to overflowing; and this might, to some extent, account for the difference in the opinions formed upon them. If the evidence for the plaintiffs was to be accepted, no doubt the water was properly condemned as unfit for domestic use. On the other hand, Sir William Crookes said that the samples analyzed and examined by his son were pure and wholesome; and his view was that he was unable to express any opinion on the analytical reports, taken by themselves, without a knowledge of the surrounding circumstances. He said that if the samples were obtained from a good gathering-ground, where there was no possibility of sewage contamination, the water was a pure and wholesome one. On behalf of the plaintiffs, Mr. Watson gave evidence as to the surrounding

circumstances; and it was impossible to maintain that these were satisfactory. Except in one case, there was an entire absence of filtration; and several of the reservoirs were unfenced. With regard to the Rhymney reservoir No. 2, there was evidence that the drainage from two farms might find its way into the water; and in one case there were no proper sanitary conveniences about the farm. A new main was being laid at this reservoir, and navvies were at work there; but no sanitary conveniences were provided, and the evidence of their absence was to be found on the ground close to the water. After referring to the other reservoirs in detail, his Lordship went on to say that it was quite clear that no actual outbreak of disease could be attributed to the supply of unwholesome water in the past. There had been typhoid fever in two streets at the time some of the samples were taken; but it was not the result of any impure water supplied by the defendants. On the other hand, it was quite manifest that where reservoirs were open to public access it was not a desirable state of things; and it ought to be remedied without delay. He had not forgotten the evidence of Sir William Crookes and his son. It was clear that there was no sewage contamination in the sense that there was any drain from water closets or from any village passing into the reservoir; but, on the other hand, there was no doubt whatever that the water was contaminated with fæcal matter. Sir William Crookes was probably right in saying that in a certain sense the water was pure and wholesome; it might be a question of degree. But, having regard to the surrounding circumstances, and to the analytical evidence, his Lordship had no difficulty in coming to the conclusion that defendants had failed to discharge in the past their statutory obligation. Complaint had been made that they had refused to do anything to render their supply pure and wholesome; but he thought this part of the case had failed. The defendants had not proceeded very quickly. But, at any rate, before the issue of the writ they had taken steps to prevent the pollution from the two farms above the Rhymney reservoir, and to get that portion of the gathering-ground under their own control; and they were fencing the reservoirs hitherto unfenced, and had intimated their intention to proceed with the construction of filter-beds—a point on which Sir William Crookes laid great stress. He was satisfied that they were bestirring themselves with a view to improving the quality of the water; and, under these circumstances, though the plaintiffs were entitled to succeed, he did not see his way to granting an injunction, the effect of which might be to deprive the inhabitants of water altogether. He thought the proper course would be to make a declaration that the defendants had failed in the past to supply pure and wholesome water, and order them to pay the costs up to and including the hearing. The plaintiffs would have leave to apply for an injunction at the expiration of six months, if so advised. It might, however, be that no further application would be necessary.

Mr. MACNAGHTEN asked if defendants might have liberty to apply, in case their arrangements were not quite finished in six months.

His LORDSHIP said it was not necessary. It was not as if defendants were under an injunction, and required an extension of time.

CHARGES AGAINST MR. GILBERT LITTLE.

At a Special Court held at Smethwick last Tuesday, Mr. Gilbert Little, of the Gilbert Little Company, Limited, Bradford, was summoned at the instance of Mr. Henry Peaty, a Director of the New Conveyor Company, Limited (with which defendant was also formerly connected). The charges were: "That on the 13th day of March, 1907, and divers other days, at the said borough, he did unlawfully and maliciously publish certain defamatory libels of and concerning the said Henry Peaty;" and "that on the 21st day of May, 1907, at the said borough, he did feloniously and maliciously send to the said Henry Peaty, a certain letter demanding of him, with menaces, and without reasonable or probable cause, certain money, to wit, the sum of £872."

Mr. Sutton Sharpe, who appeared for the defendant, said the cases were of a somewhat unusual character. The charges were dated July 5, and were served on his client on the following day, when he was on the point of starting to keep an important engagement in Ireland. He had not seen his client, and, of course, knew nothing of the matter; and the charges were of such a character as to need very careful consideration and preparation. He therefore asked for an adjournment, so that he could communicate with Mr. Little, who would be happy to attend in order to meet the charges. The dates of the alleged offences were March and May; and if the prosecution had been so terribly anxious to take proceedings, there was ample time, and they could have chosen a more convenient date.

For the prosecution, Mr. Willison pointed out that the summonses were served personally, and that a warrant could have been taken out by application to the Court in the first instance. The defendant should not have abstained from attending that day. If he had been present, and said that he wanted an adjournment, the position would have been different. After a considerable amount of opposition on the part of Mr. Sharpe, and an expression from the Bench that the case should not be gone into then, Mr. Willison said he was convinced that it would be the shorter and better course to allow him to say what he wanted to bring before the Court. If Mr. Sharpe had merely made his application and not gone into circumstances about things being delayed, he should have said nothing; but he denied that it was his intention to prejudice the case against Mr. Little. He did want them to know the true circumstances. A verdict had been obtained against Mr. Little in an action; and he wanted them to know that the letter which formed one of the charges—the demand to obtain money by certain menaces—was received on May 18. Since then letters had been sent all over the country to various people reflecting in the most serious way upon Mr. Peaty, and intimating what would happen if he did not pay £872. Letters and post-cards were received as late as July 2, so they would see the importance of the proceedings from Mr. Peaty's point of view. The summons was issued the next day. In view of the Magistrate's intimation that it was a proper case for an adjournment, he must ask at this stage that Mr. Sharpe should give an undertaking that no more letters would be sent about the country reflecting upon his client's character. It was a matter which must be dealt with in the firmest way possible. He accepted the decision of the Magistrate; and observed that if defendant did not attend, there should be a warrant for him. He thought that in fairness to the prosecutor this undertaking should be given. He was entitled to ask that the objectionable post-cards should cease at once. He thought Mr. Sharpe would have volunteered the undertaking.

Mr. Sharpe replied that he would wire at once to his client, informing him of the result of the day's application, and instructing him that under no circumstances was he to write anything further. He said this without any knowledge of the contents of the letters.

The case was then adjourned until the 25th inst.

The Gaslight and Coke Company Fined.

At to-day's meeting of the London County Council, the Public Control Committee will report that proceedings were taken against the Gaslight and Coke Company in respect of deficient illuminating power at the Council's Testing Office, No. 3, Vincent Terrace, Islington, on the 18th of November and the 2nd of December, 1906, and the 27th of January, 1907; the illuminating power being equal to only 14·89 candles, 14·97 candles, and 14·83 candles respectively, as compared with the statutory obligation on the Company to supply gas of 16-candle power. The cases were heard by the Chief Gas Examiner at the office of the Metropolitan Gas Referees on the 27th of June, when a forfeiture of £50 was imposed in each case—the amount being payable to the Receiver of the Metropolitan Police District.

Dispute as to the Value of Gas-Governors.

At the Southwark County Court, last Tuesday, Judge Willis, K.C., had before him the case of *Tyce and Co. v Fielder*, in which the question of the value of gas-governors arose. Plaintiffs are gas engineers in Union Street, Borough, and the defendant is the proprietor of the Black Bull, Stratford. It appeared that in 1904 plaintiffs supplied four governors to the defendant's house, on the understanding that they were to receive one-half the saving effected in the gas bills, or £15 10s., as the purchase-money. For the defence it was contended that the light was worse after the governors were fitted than it was before, though there was an admitted saving in gas; and they were taken off in March last year. His Honour gave judgment for £7 10s. and costs, for the use and enjoyment of the governors for two years. Leave to appeal was refused; his Honour saying there was nothing to appeal about.

Belfast and the Laying of Mains in Cregagh.

In the "JOURNAL" for June 11 (p. 750) there was a report of an arbitration between the Belfast Corporation and the Down County Council, with reference to the laying of pipes in a portion of the Cregagh district to which the Corporation have a right to supply gas. The Corporation wished to place them in the footway; while the Council wanted them in the centre of the road underneath the tramlines. During the proceedings, Mr. Lewis, who appeared for the Corporation, suggested the possibility of the sewer-pipes being laid 6 feet under the footway, and then the gas-pipes could be laid above them, at a depth of 1 ft. 6 in. from the surface. An adjournment was made, to see if there would be any engineering or other objection to this suggestion. Since then, the Gas Manager (Mr. R. Sharpe) has reported to the Belfast Gas Committee the result of an interview he has had with the Engineers of the Down County Council and the Rural District Council and the City Surveyor; stating that it had been arranged to lay the main in the footpath, "on certain conditions." These the Committee approved of; and the Manager was authorized accordingly.

Hindley Gas-Works Report.—In his fourth annual report, dealing with the operations of the Hindley Gas-Works during the year to March 31 last, the Manager (Mr. H. O. Timmins) remarks that the number of ordinary consumers decreased from 2456 to 2436; while the prepayment meter users increased from 1636 to 1823. There was thus a net increase of consumers of 167, or about 4 per cent. The gas made was 87,188,300 cubic feet, compared with 84,567,600 the previous year; the increase being equal to a little over 3 per cent. There was a slight decrease in the unaccounted-for gas, though several serious breakages took place through subsidences. The net profit for the year is £631; but Mr. Timmins points out that if, as is the general practice in other towns, the prepayment meters had been treated as a capital charge, instead of being placed to revenue, the net profit would have been about £980.

Public Lighting at Castle Donington.—The public lighting question at Castle Donington, which has been discussed for some time, was last week referred to a general meeting of the ratepayers. The trouble arose through the fact that the terms offered by the Gas Company for the lighting of the town were considered by the Council to be excessive. At the meeting, Mr. L. Stevenson, on behalf of the Council, said that conferences had failed to reach an amicable settlement. The terms of the Company were in excess of those of last year; and instead of these being reduced after representations were made to the Company, they were still further increased. It had been urged that the advance in the price of coal was the reason for the higher figure. The Council were not actuated by any bad feeling towards the Company, but they were bound to watch the interests of the ratepayers. There were alternative systems of public lighting which he would venture to say would be quite as effective as, and far more economical than, gas. Mr. F. E. Burton, a Director, assured the meeting that the Company had done everything in their power to meet the Council fairly; but there had been an advance in the price of coal of from 20 to 25 per cent. It was resolved that the Council be recommended to make the best terms possible with the Company for the lighting of the town; gas to be supplied through meters. The meeting also passed a vote of confidence in the Council.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY AND METER-RENTS.

At the Meeting of the London County Council to-day, the following report of the Public Control Committee, dealing with the proposal of the Gaslight and Coke Company to re-impose meter-rents, instead of raising the price of gas to meet the increased cost of coal, will be presented.

The Gaslight and Coke Company have approached us with a proposal that the question of charging rents for gas-meters should be re-opened. The Company desire, instead of raising the price of gas as other companies are doing, in consequence of the rise in the price of coal, to reimpose, with the concurrence of the Council, a charge in respect of gas-meters. This proposal is made in the undermentioned circumstances.

The Gaslight and Coke Company alone among the London Gas Companies do not charge their consumers a rent for meters; and it will probably be within the recollection of the Council that the question of meter-rents, which had been abolished by the Company in 1895, was the subject of negotiations between the Council and the Company in the year 1903, on the occasion of the Company's last application to Parliament. The standard price regulating the dividend which the Company are entitled to distribute was then fixed, having regard to the practice of the Company in making no charge for the use of meters; but they did not surrender their legal right to make such charge. The Company now state that, in consequence of the recent increase in the price of coal and oil, they are faced with the necessity of increasing their income; and one way which suggests itself is the re-imposition of this rent. The scale of charges submitted to us is estimated to produce £60,000 a year, an amount equal to ¾d. per 1000 cubic feet of gas sold. The alternative method of raising the required sum is by increasing the price of gas by 1d. per 1000 cubic feet—viz., from 2s. 11d. to 3s.—the effect of which would be to require consumers to pay an additional sum estimated at £80,000 a year. The re-introduction of meter-rents would, the Directors believe, obviate the necessity of raising the price of gas; and they express their willingness to pledge themselves not to do so for a period of at least twelve months.

To consumers on the south side of the river, and for public lighting throughout the Company's whole area, the price charged by the Company for gas follows automatically that charged by the South Metropolitan Gas Company. The Gaslight and Coke Company will therefore, in respect of gas sold south of the river and for public lighting, obtain the benefit of the increase of 3d. per 1000 cubic feet, of which the South Metroplitan Company have given notice as from Midsummer, 1907. This, however, will not produce the whole amount required by the Gaslight and Coke Company.

The Company feel that, owing to the non-charge of meter-rents, they suffer by comparison with the other London Companies, by reason of the fact that the price charged for gas has in reality to include such rent.

The Company urge that another advantage of charging a meter-rent instead of increasing the price of gas would be that the consumers who use automatic meters, and who approximate to over 50 per cent. of the total consumers of the Company, would not have to pay a higher charge than they are at present paying, as the proposed new charge would not apply to them. A further advantage attaching to meter-rent is that it is a fairer charge, as such rent would have to be paid by all the Company's ordinary consumers (with the exception hereinafter mentioned as regards the City of London). Many of these now merely use gas as a standby, and have large meters standing idle, costing the Company money for which they get no return—an expense which, of course, has to be borne by the consumers as a whole.

The Company are under a special restriction as regards the supply of gas within the area of the City of London; and in that district, though bound to supply a meter for the use of consumers, they are precluded from charging a rent for its use. It was owing largely to this differentiation between consumers within and without the City that the Company were induced in 1895 to adopt the policy of not charging for the use of meters.

The result of the negotiations between the Council and the Company in 1903, to which we have previously referred, was reported to the Council on May 19, 1903; but it will be convenient to review briefly the negotiations. In the sessions of 1903, both the Council and the Company introduced Bills into Parliament having to a large extent the same object—viz., to carry out the recommendations of Sir James Rankin's Committee of 1899, and to give effect to the conclusions arrived at by the Conference of Local Authorities convened by the Council, and held at the County Hall on March 7, 1902. The main question on which negotiations took place was the extent to which the existing standard price of 3s. 9d. was to be reduced. The Council urged 3s. 3d., as recommended by Sir J. Rankin's Committee; the Company provided for 3s. 6d. in their Bill, but at an early date made an offer of 3s. 5d., giving up their powers to reimpose meter-rents which they had not charged since 1894, or 3s. 4d. with the reimposition of meter-rents. It was evident that the Company were entitled to some consideration to the extent of nearly 1d. as compared with the other Companies who were charging meter-rents; and the Council therefore suggested a standard price of 3s. 4d., the position of the Company as regards meter-rents not being disturbed. Ultimately an agreement was come to that the following statements should be made to the Committee of Parliament which was then considering the Council's Bill, which, as introduced, provided for a standard price of 3s. 3d. On behalf of the Company it was stated: "The policy of this Company is not to charge meter-rents, and the Directors have no intention of re-imposing the charge in the case of ordinary consumers; but they object to the power of making the charge being taken away from them while it is both retained and exercised by the other Metropolitan Companies;" and on behalf of the Council it was stated that: "The Council have assented to the standard price of 3s. 3d. as proposed by their Bill being altered to 3s. 4d. The Council agree to the standard price being fixed at this figure, relying upon the assurance given on behalf of the Company as to their policy with respect to meter-rents."

The Council's Bill was subsequently withdrawn, and the Company's Bill became law; the standard price being fixed at 3s. 4d. per 1000 cubic feet.

Though it is quite within the power of the Company to re-impose a charge for meter-rents, such a course, if adopted without the consent of the Council, would, in our view, be a violation of the above understanding; and we believe that the Company concur in this view. We have therefore considered whether the proposals put forward by the Company are such as the Council should approve.

The income of the Gaslight and Coke Company, owing to the action of the South Metropolitan Gas Company to which we previously referred, will, so long as the latter Company maintain the higher charge, be increased by about £26,000 a year. This sum, however, falls short of the required revenue.

With the Company's present price of gas (2s. 11d. per 1000 cubic feet), the dividend which the Company are entitled to distribute on the nominal ordinary capital is £4 10s. 8d. per cent. This dividend is, owing to the conversion of the capital under the Company's Act of 1898, equivalent to £11 6s. 8d. per cent. on the original capital, subject to the sliding-scale. The Company are now distributing £4 8s. (or 11 per cent. on the original capital), which would be the statutory dividend with gas at 3s., or 1d. more than the price actually charged. It is obvious, therefore, that the Company can increase the price of gas by 1d. per 1000 cubic feet without affecting the dividend which they are now paying—in other words, that the increased cost of gas to the extent of 1d. per 1000 cubic feet would, if this course were followed, fall wholly on the consumers.

As the present position is obviously due to temporary causes, it is necessary for the Council to guard against the possibility of the Company securing a permanent advantage from the change at the expense of the consumer; and, in order to judge of the effect of the proposals, it is necessary to consider what their effect will be in a normal year.

The revenue from meter-rents, when the temporary conditions shall have passed and the cost of production is again cheapened, would be available for reduction in the price of gas to (say) 2s. 10d. per 1000 cubic feet; and, under the sliding-scale, gas sold at the price of 2s. 10d. would entitle the Company to pay a dividend of £4 13s. 4d. per cent. This would be manifestly unfair; and to meet this point, the Company are prepared to sacrifice any advantage as to dividend they might obtain through the introduction of meter-rents. Though the Company estimate the additional charge thrown upon the consumers as the equivalent of ¾d. per 1000 cubic feet, they are prepared to give an undertaking to the Council (to be embodied in the Company's next Act) that the authorized dividend shall in future be calculated as if the price of gas were 1d. per 1000 cubic feet higher than that actually charged. This is, in effect, a reduction of 1d. in the standard price; and in this form the necessary statutory alteration would in due course be made.

There will remain, however, the differentiation between consumers in the City of London and those outside. To a slight extent, the gas consumers in the City will benefit at the expense of the consumers in the remainder of the Company's area. The annual value of the meter-rents installed in the City for which no charge can be made is, according to information given by the Company, £9000.

Statements have been furnished showing the number, sizes, and average consumption of the Company's ordinary meters outside the City of London, and the proposed charges for meter-rent. The following table shows the effect on each class of consumer of the proposed charge for the use of meters, as compared with an increase of 1d. per 1000 cubic feet of gas:—

Size of Meter.	No. of Meters.	Average Annual Consumption. Cubic Feet.	Proposed Annual Charge for Meter. s.	d.	Cost of 1d. per 1000 Cubic Feet on Price of Gas. s.	d.
3-light . . .	27,007	19,800	2	0	1	7·6
5-light . . .	102,039	38,300	3	0	3	2·3
10-light . . .	60,087	61,000	5	0	5	1
20-light . . .	21,528	110,800	8	0	9	2·8
30-light . . .	7,577	162,100	12	0	13	6·1
50-light . . .	4,516	295,000	16	0	24	7

Consumers taking their gas by automatic meter already pay for the use of their meters in the form of an additional charge for gas, and in the event of the Company reimposing meter-rents will not have to pay anything more than at present. These consumers now number 261,394—*i.e.*, over 50 per cent. of the total consumers of the Company—and use on the average 14,000 feet of gas a year. If the price of gas be increased, this large body of consumers will be prejudicially affected.

There appears to us to be some force in the proposal of the Gaslight and Coke Company to charge meter-rents, more especially as such rents are charged by all the other Gas Companies in and around London; and as the consumer must now apparently bear an increased charge owing to the rise in price of coal, the opportunity occurs for levying this necessary increase in what cannot be regarded as an inequitable manner.

After careful consideration of the question, we think that, in the interests of the public, the Council should acquiesce in the proposal of the Company; and the principal considerations which have influenced us in arriving at this conclusion are—

(i.) That the large number of consumers taking their gas by automatic meters will not be charged at a higher rate.

(ii.) That the average increase to the majority of the ordinary consumers will not be quite as much in respect of meter-rents as the increase of 1d. per 1000 cubic feet in the price of gas.

(iii.) That the charge for meters is fairer in its incidence than an inclusive charge for the price of gas.

(iv.) That the Company, by consenting to a reduction of 1d. in the standard price of gas, will forego a share of the additional income from the meter-rents to which the stockholders would otherwise be entitled in the form of increased dividend under the sliding-scale. The whole of this additional income will therefore

enure to the permanent benefit of the consumers in the form of a reduction in the price which would otherwise be charged for gas.

We therefore recommend : (1) That no objection be offered to the Gas-light and Coke Company charging meter-rents from Midsummer last, on the scale submitted, subject to the Company giving an undertaking—

(i.) That the authorized dividend which the Company are enabled to declare shall in future be calculated as if the price of gas were 1d. per 1000 cubic feet higher than that actually charged; and that the necessary provision to give effect to this be embodied in the next Bill which the Company introduce into Parliament.

(ii.) That the price of gas to the Company's ordinary consumers north of the Thames will not be increased beyond the present price of 2s. 11d. per 1000 cubic feet for a period of one year from June 24, 1907.

(2) That the Solicitor do prepare and obtain the execution of the necessary undertaking; and that the seal of the Council be affixed to such undertaking (in duplicate) when ready.

ACCIDENTS WITH COAL GAS AND OTHER ILLUMINANTS IN GERMANY DURING 1906.

Following up his article entitled "The Alleged Dangers of Coal Gas,"* Herr Schäfer, of Dessau, recently gave, in the "Journal für Gasbeleuchtung," a list of the accidents known to him (where human life was jeopardized or lost) which occurred during the production of artificial light or heat throughout the whole of Germany in the year 1906.

Herr Schäfer's general results are included in the annexed table:—

No. of	Coal Gas.	Electricity.	Paraffin Oil.	Alcohol.	Benzoline.	Acetylene.
Accidents . . .	112	42	199	119	53	24
Men injured . . .	149	46	218	140	62	34
Men killed . . .	41	35	127	58	15	10

Examining the figures in the table as a whole, it will be observed that gas was only responsible for 14·3 per cent. of the 286 deaths; paraffin oil causing 44·4 per cent.; alcohol, which is only used on a very small scale as a source of light, heat, and power, causing 20·3 per cent.; and electricity—the medium that is always said to be so very safe—causing as many as 12·2 per cent.

Coal Gas.—The number of accidents and of persons injured by coal gas were only a little larger than in the previous twelve months; but the number of men who were killed rose from 17 to 41—the serious increase being due to several severe accidents in different gas-works. Seven cases in which thirteen people are known to have been murdered or to have committed suicide are not included in the table; but the figures do include four fatal cases which were either suicides or accidents. Among the victims of coal gas, 26 officials and men in gas-works were injured and another 11 killed. Nearly all the accidents due to gas were brought about by carelessness or disobedience to well-established rules. In fact, the process of looking for a leak with a naked light caused 51 accidents, of which two were fatal; while another 17 explosions accompanied by six cases of poisoning (mostly fatal) occurred through the end of a service-pipe being left uncapped after some gas fitting had been removed, or through the main service-cock being shut and then opened again at a time when a burner-cock was on. Eight accidents, involving the loss of five lives, were due to the perishing of rubber tube or its slipping from the connections. The escape of gas from broken mains caused three accidents, and badly-acting geysers another three. Two severe cases of poisoning followed the use of instantaneous tap-water heaters—appliances which are still occasionally employed in spite of all warnings.

Electricity.—The total number of deaths caused by electricity rose from 15 to 35 last year. One case might have been accident or suicide, another was bravado, two were caused by attempts to steal current, three others were due to interference with a high-tension lead by drunkards, one fatal case followed injury to a man's eyes caused by the explosion of a new glow-lamp, while another was a fatal accident to a fireman in the employ of a tram company—two of his mates being injured. The remaining cases arose from accidental contact with a conductor; officials and men in the generating stations or erecting installations being the chief sufferers. It is worth noticing that artificial respiration very seldom was successful when applied to persons injured by the current; whereas it was comparatively often quite successful in the case of men severely gassed.

Paraffin Oil.—The number of fatal accidents due to paraffin oil fell largely from the previous year—*i.e.*, from 202 to 127; the decrease being primarily attributable to the smaller consumption of oil, owing to the competition of gas and electricity. The great majority of the more severe accidents rose from the explosion of vessels containing paraffin oil at the moment of pouring it into a badly-burning fire, or into a lighted lamp or stove which was nearly empty. Hence, the victims were chiefly half-grown children, servants, and young women. The remainder of the accidents were explosions at the moment of lighting a lamp or stove, or the falling or blowing out of such apparatus. The portability of paraffin lamps, which is so frequently held up as one of their chief advantages, caused fourteen serious accidents. A very considerable proportion of the accidents with petroleum took place in large or medium-sized towns which had been supplied with gas for years, and it would therefore seem desirable that the proprietors of the gas-works should take better steps to bring the advantages of gas to the notice of the inhabitants.

Alcohol.—The total number of accidents caused by alcohol was larger than during the previous twelve months; the fatal cases rising from 53 to 58. In nearly all instances the cause was returned as pouring spirit into a nearly exhausted lamp or stove which was still burning; but nineteen cases were ascribed to spontaneous explosion, eight of which caused injury. Many of these accidents with alcohol occurred in large towns, eight being reported from Munich and five each from Berlin, Frankfort, and Cologne.

Benzoline.—As shown in the table, fifteen persons lost their lives through the explosion of apparatus consuming benzoline and similar petroleum products, or through fires originated by the same material. Most of these accidents occurred in dry-cleaning works, in connection with boiling or soldering lamps and motor-cars. The chief cause of the accidents was carelessness with a naked light; but in several instances it is stated to have been spontaneous ignition.

Acetylene.—The number of accidents and of persons injured by acetylene was practically the same as in the previous year. Most of the victims were hotel proprietors and their staffs, or men engaged in repairing the apparatus. In nearly every instance the explosion was due to a light being taken into the apparatus house when the plant was out of order, to smoking, or to the thawing of frozen apparatus with soldering lamps, &c.

Numerous accidents occurred in Germany during 1906 in connection with the use of gases and liquid fuels not mentioned in the table. Pressure and suction producer gas caused seven accidents—four men being killed; blast-furnace gas caused three accidents, and one case of poisoning in which three men were killed; air gas caused three explosions without doing much damage to life; the compressed coal gas known as "Blaugas" caused three explosions, resulting in injury to twelve men and the death of one other; railway oil gas gave rise to three explosions, in one of which two persons were slightly injured. During the year 1906, on 73 occasions, there were cases of carbon monoxide poisoning from the combustion products of fuel. These accidents resulted in 136 persons being injured, of whom more than half succumbed in spite of treatment. Most of the accidents occurred in East Prussia, but others were reported from towns in the centre and south of Germany, under circumstances which seem to indicate that the injury would not have been done if gas had been used instead of charcoal in the apparatus concerned.

* See "JOURNAL," Vol. XCVI., p. 807.

ACCIDENTS AT THE SOUTH SUBURBAN GAS-WORKS.

A Remarkable Fire.

The South Suburban Gas Company are at present adding a fourth lift to each of their two large gasholders; and the alterations which are being carried out by Messrs. Clayton, Son, and Co., have been in progress for some months. Last Friday the work was interrupted most unexpectedly by an accident—unique, we believe, in the history of gas lighting—which happened in the smaller of the two holders. When the water was taken out of the tank some weeks ago, it left behind, upon the "dumpling" and bottom of the tank, a very thin coating of naphthalene; and on Friday last, when the workmen commenced to rivet together the plates of the new lift, a hot rivet fell to the bottom of the tank and set light to the naphthalene. The fire spread rapidly, and soon the whole of the dumpling was ablaze, and the timber framework supporting the roof caught fire. Fortunately there is a fire brigade station within half-a-mile of the works; and, in response to a telephone message, an engine reached the works within five minutes of the outbreak, speedily followed by four others from more distant stations. These quickly extinguished the fire; and, beyond the charring of the timber framework, no damage was found to be done. Five men were at work at the bottom of the tank at the time of the outbreak; and they escaped by means of the ladders fixed in the tank. The last of them to ascend, however, passed through the flame, and, strange to say, was not burned, although he was nearly stifled by the smoke. He received instant medical attention, and was soon able to be sent home, where in a short time he recovered from the shock. Much consternation was caused in the neighbourhood of the works by the great cloud of smoke which rose from the tank, for it was feared that it would be followed by an explosion.

Later in the day an accident happened to a workman engaged in the alterations to the adjoining holder. He was employed in riveting the sheets of the new lift, and was working on a platform suspended by ropes between the side sheets of the outer and inner lifts. In attempting to raise the platform, the support above, to which the rope was attached, gave way, and he fell headlong on to the edge of the cup, 30 feet below, and sustained severe injuries to his head, beside breaking his collar bone. He was extricated with some difficulty and sent to the Lewisham Infirmary, where he is going on as well as can be expected.

THE ADVANCE IN THE PRICE OF COAL.

Sir George Livesey's Views.

As recorded in a paragraph which appears elsewhere, the leading Railway Companies are resisting the demands of the South Yorkshire Coal Owners for an advance of 3s. 6d. per ton in the price of coal; and, as readers are aware, the South Metropolitan Gas Company took up an equally firm attitude. The Chairman (Sir George Livesey) was recently interviewed on the subject by a representative of the "Observer," who was informed that the Company would now have to pay an additional £240,000 for the 1,200,000 tons of coal they consume in the year, which brings the total up to £940,000. "Cheap coal is as essential to this country as cheap bread," said Sir George; "and the action of the coal owners and miners in putting up the prices as they have done is to the disadvantage of everyone. I am a Free Trader, but I don't go to the extent of saying that we should supply the foreigner with our coal, which is our capital, and which we shall want some day. The foreigner gets his coal cheaper, and we have to pay more in consequence. If the coal tax had not been taken off, we should have kept our £2,000,000; and it would probably have increased now to more than double this amount." Sir George predicted that the Miners'

Eight Hours Bill had no chance of passing this year, as the Government would not take it up. The Committee on the Bill had made a valuable recommendation—viz., that it was not a question merely of coal owners and miners, but also of a third party, the coal users; and if the Bill resulted in increasing the cost of coal, this third and most important party would be the losers. "If the Miners' Eight Hours' Bill were to pass," said Sir George, "the tendency would be to make the coal owners and miners unite for their mutual interest, and to the disadvantage of the public."

To show the upward trend of prices, Sir George Livesey mentioned that two years ago his Company paid 7s. 6d. a ton free on board in the Tyne. When they made their contract three months ago, they got on at 11s. 9d. a ton; and the present prices quoted for gas coal ranged from 13s. to 14s. "So long as the foreign demands last, so long will the prices be kept up here," he added; "but I am looking forward to a collapse of this precious boom in the iron trade, and am hoping we shall not have to wait long for it."

PRICE OF GAS AND COMMODITIES IN AMERICA.

In our contemporary "Progressive Age" for the 15th ult., there was published a statement by the General Manager of the Milwaukee Gas Company (Mr. Glass) in support of an argument before one of the Committees of the Wisconsin State Legislature against the removal of the word "exclusive" from the Company's franchise. Mr. Glass claimed—and apparently on good grounds—that the exclusive franchise of the Company had been worth millions of dollars to the people of the city; and he produced a table, compiled from official data, showing the rates charged for gas in fifteen leading cities of the United States for 23 years (1885 to 1907), the rate in Milwaukee, and the average rate for the cities named. Ten of them had, at one time or another, competitive plants, with the result that some of the streets had seven separate lines of mains, and many of the houses half-a-dozen service-pipes each; two had municipal ownership, with the most disastrous results; and the other three had conditions not unlike those of Milwaukee, except that two of them had the advantage of low-priced coal and oil.

The facts presented by Mr. Glass showed that the public of Milwaukee shared in the economical and progressive management which an exclusive and undisturbed franchise facilitates. The figures presented by him were mainly of interest locally; but our contemporary has placed them in juxtaposition, in tabular form, with the range of wholesale prices, for similar periods, of some of the common necessaries of life, in order to show that while gas companies have reduced the cost of their product to the consumers, that of other commodities has been increased, and without any public protest. The following are some figures from the table referred to:—

Year.	Average Price of Gas.		Wholesale Prices for Foods.					Price of Coal per Ton.
	15 U.S. Cities	Milwaukee (Wis.).	Bread per Pound.	Butter per Pound.	Beef per Barrel.	Milk per Quart.	Potatoes per Bushel.	
			Cents.	Cents.		Cents.	Cents.	
1885	$1·57	$1·40	..	..	..	..	..	..
1886	1·51	1·40	..	..	..	..	..	..
1887	1·41	1·40	..	..	..	..	..	..
1888	1·40	1·20	..	..	..	..	..	..
1889	1·40	1·20	..	..	..	..	..	..
1890	1·36	1·20	3·5	19 5	$14·5	26·3	59·6	$3·71
1891	1·36	1·00	3·5	23·8	15·5	26·7	77·3	3·85
1892	1·31	0·95	3·5	23·5	14·6	26·8	45·5	4·15
1893	1·31	0·94	3·5	25 2	17·8	27 9	67 1	4·19
1894	1·18	0·93	3 5	20·9	18·4	26·3	61·3	3·60
1895	1·18	0·92	3·5	18·8	17·3	25·3	43·3	3·13
1896	1·15	0·92	3·2	16·6	15·9	23·4	19·6	3·79
1897	1·10	0·92	3·5	16·8	22·6	23·5	32·8	4·01
1898	1·10	0·91	3·5	17·5	21·5	23 9	50·9	3·80
1899	1·09	0·89	3·5	19·6	22·7	25·3	41·7	3·70
1900	1·02	0·88	3·5	21·1	20·6	27·4	37·4	3·94
1901	1·02	0·88	3·5	20 1	20·3	26·2	56·4	4·32
1902	1·01	0·88	3·5	23·2	21·3	28·8	59 6	4 46
1903	1·01	0·87	3·5	21·5	21·2	28·8	52·5	4·82
1904	0·99	0·86	3·7	19·7	22·3	27·5	73·0	4 82
1905	0·96	0·85	4·0	23·4	22·0	28·9	40·3	4 82
1906	0·93	0·85	4·0	23·2	21·6	30·1	54·8	4·86
1907	0·91	0·76	..	..	..	..	..	..

Our contemporary says a glance at the table will show that gas companies are doing better for their consumers than any other public supply industry; and this fact should be thoroughly advertised in every town supplied with gas, whether an agitation is in progress or not. The question of gas price should be considered as the product of conditions; and the public newspapers should never be allowed to say that, if another city can have gas at a named price, they also should purchase it at the same figure.

Public Lighting in Hammersmith.—At the meeting of the Hammersmith Borough Council last Wednesday, it was reported that a letter had been received from the Gaslight and Coke Company notifying that on and after the 1st inst. the price of gas supplied by the Company to all public lamps both north and south of the Thames would be increased from 2s. 2d. to 2s. 5d. per 1000 cubic feet, rendered necessary by the increased price of coal and oil. The Finance Committee instructed the Electrical Engineer to report to the Electricity and Lighting Committee as to the advisability of lighting by electricity all the public lamps in the streets where mains are laid.

INSPECTION OF FACTORIES AND WORKSHOPS.

Annual Report of the Chief Inspector.

The report of the Chief Inspector of Factories (Dr. Arthur Whitelegge), for the year ending the 31st of December last, was issued on Thursday. It shows that at that date there were upon the registers 109,065 factories and 146,124 workshops, including laundries, but not men's workshops, docks, warehouses or buildings, private lines and sidings or (in general) domestic workshops. The number of persons employed in factories is approximately 4,150,000; in workshops (excluding men's), 700,000; and in laundries, 100,000. A table giving the figures of the distribution of new factories and workshops in the past year shows that the gas-works numbered 74; being 47 in England and Wales, 10 in Scotland, and 17 in Ireland. There were 35,696 accidents reported to certifying surgeons, and 76,208 to inspectors only; making a total of 111,904—an increase of 11,295, or at the rate of 11·2 per cent. Of the accidents reported to the certifying surgeons, 1116 were fatal. Of these 17 were in connection with gas manufacture (a decrease of 9); and 293 accidents (an increase of 81) were non-fatal. The Chief Inspector calls attention to the fact that the Truro Gas Act, the Tottenham and Edmonton Gas Act, and the Cumberland Electricity and Power Gas Act of last session, like other recent Acts authorizing the manufacture and distribution of power gas, require that the gas shall be odorized. But in place of the provision in the earlier Acts, that the proportion of carbonic oxide shall not exceed 14 per cent., power is given to the Secretary of State to make regulations concerning the supply of the gas, in order to ensure the safety of persons concerned. The duty of enforcing the provisions of the Act, as well as of the regulations that may be made thereunder, in factories and workshops, is imposed on the Inspectors of Factories.

Following the report of the Chief Inspector are those of the Superintending Inspectors of the different divisions. Dealing with the southern division, Mr. W. A. Beaumont gives some reports from District Inspectors on the subject of suction gas. Mr. Harston (Kent) says several important plants have been introduced in factories; and the cost of working a 10 H.P. engine is computed to be only 1d. per hour. The cost of producing the same amount of power by steam is said to be about 1s. per hour. Mr. Shuter (Plymouth) says there is strong evidence of the suction-gas plant rivalling the electric motor as a motive power. In numerous places this plant is being laid down either as a substitute for, or an auxiliary to, other power; and he hears it spoken of very highly by those in charge. Mr. Beverley (West London) states that there has been an increase of these plants, using anthracite coal; and the saving in cost compared with some of the older types of steam-engines has been quite remarkable. Mr. W. V. Smith (Norwich) says numerous suction-gas plants have been laid down, especially in the more remote villages. In the larger towns this is also a common occurrence, on the grounds of economy. Mr. Beaumont reports that the inspectors were busy last year in securing a reasonable temperature in workplaces; in condemning naked gas-jets for heating purposes, where they occurred; and discouraging flueless gas-stoves, which, he says, at the best involve additional ventilation. Mr. Shuter says that frequently the only means of maintaining a reasonable temperature is by gas-jets—a mode he always condemns; and some air samples taken with the object of ascertaining the effect of this mode of heating on the atmosphere amply justified the condemnation.

Mr. Beaumont devotes a portion of his report to gas-works. He says the importance of structural and administrative details in these works, emphasized by the Saltley explosion in 1904 and by the further warning afforded by the calamity at Coventry last year, has been impressed upon those concerned; and particular attention is now being paid to the type of purifier-houses, the methods of emptying them, and the locating of escapes of gas. Mr. Wright (North London) records the issue of instructions in one instance in which there were insufficient openings in the built-up walls of a purifier-house, and no openings or louvres in the roof. Beyond this, no bad examples of unventilated purifier houses have, at the present stage of the inspectors' inquiries, been reported. Instances occur, however, of poorly constructed ones; while in contrast with them are those on the highly desirable open-shed principle. Hence, in many cases not only is the accumulation of gas (in the event of escape) prevented, but need for artificial light does not arise. Next best to this, though not entirely immune from risk, the use of electric torches is adopted, with certain exceptions. Mr. Snape (Bristol) says that in some cases electric lamps are in use. The plan adopted in other places is the insertion of a gas-jet in a box enclosed in the outer wall, with a pane of glass on the inner side. Generally speaking, the building is either lofty and spacious, or an entirely open shed. In the few exceptions, special precautions are taken. In some cases the valves were faced, and no water-seals were used. Attention was drawn to these important points.

Mr. Edwards (the Inspector in charge of the counties of Hampshire, Dorsetshire, and part of Wiltshire) has furnished a report descriptive of difficulties to be contended with generally, and showing the conditions in his particular district. He says:

The reason for the construction of four solid walls in purifier-houses is that it is held to be necessary to protect the purifier-boxes from the effect of extreme cold. This necessity does not exist in this district, and nearly all boxes are therefore in the open air, covered by a pillar-supported roof only. The question of lighting the houses safely is of particular importance, and the only truly safe solution appears to be the entire disuse of all inside lights. The old hand safety lamp has been tried, and produced serious results at Saltley and Coventry. Electric lighting has been tried, and produced serious results in Dublin. In fact, it is not an unknown event for gas explosions to be caused by the fusion of electric cables. During a recent visit, I found that at one works inside lights had been discontinued in the meter and governer houses; the purifier-houses being open. Governor-houses are the most dangerous places in gas-works, because the governors have the full pressure of gas due to the weight of the gasholder, and it is then necessary to take the governor valves out for examination from time to time, and also because water-lutes form an essential part of the governor. The possible danger of an explosion in these houses was so evident that the manager first tried electric light inside, taking the precaution of passing the flexible leads through pipes, and covering the incandescent lamps with an

outer globe. This was discontinued through fear of fusion when there was an escape of gas. Now large lamps are placed outside the windows, and no inside lights are provided or allowed. Water-seal purifiers are being rapidly replaced by solid-lute purifiers; the seal being made by means of a rubber ring. These are far better than the water-lute purifiers, especially when a safety seal is provided—*i.e.*, an outlet terminating well up above in the open, with a water-seal at the top, which in the event of a blockage prevents any chance of danger. Water-lutes—*i.e.*, water-seals—are far from being satisfactory, because a heavy pressure of gas in the purifier forces the water up; and once it starts trickling over the outer lip, its resistance begins to become less, until there is a danger of its becoming almost *nil*. Big centre-valves are only found in the old purifier-houses, and are being replaced by "Weck" valves, or else separate inlet and outlet valves on each purifier.

Mr. W. V. Smith (Norwich) reports that in an exceptional case a "patent safety" oil-lamp was used, and the firm promised to get an electric torch. In all other cases either electric torches were provided or no source of light was necessary owing to the houses being of open construction. Many purifier-houses, however, are of an enclosed nature. An improvement could be effected by knocking out the windows. The opinion was expressed that the purifiers worked more freely in houses of the enclosed type, and that absorption took place more rapidly than in the open houses, where the cold was too great in winter. Others pointed out the risk of the water-seal freezing; but one manager thought this did not matter if the seal was deep enough. The risk would be avoided uy using "rubber-joint" purifiers. Mr. Harston reports the general use of open sheds in the Kent district. Mr. Kellett (Northampton) and Mr. Shaxby (East London) furnish reports on actual explosions in gas-works. The former states that an explosion occurred at a gas-works whereby five men were injured. They were employed riveting an iron cover in the purifier-house. It is supposed that a hot spark from a rivet ignited the gas accumulated in the house, though the traps, &c, were well sealed and the house was well ventilated. From experience of similar explosions, he thinks it advisable that, when this class of work is to be done, the cover or tank should, if possible, be removed into the open air. Mr. Shaxby says an explosion of benzine vapour in the governor-room of a gas-works was attended by serious consequences. An apparatus for supplying benzine vapour to the coal gas was installed, and it included a small pump fitted with a drain-cock communicating with the benzine. Liquid, escaping from this opening, formed an explosive mixture in a confined space, and was promptly ignited by the test flames. [These had been provided in the governor-room partly for its illumination and partly to indicate the quality of the gas before and after enrichment.] Electric light is to be used for the future; the test flames are to be banished to another room; and the drain-cock is fitted with a pipe discharging only in the open air.

Under the heading "Carbon Monoxide Poisoning," Mr. Beaumont points out that the inspectors have been under instructions concerning its danger, which, he says, has been increased "by the growing use of producer gas, Mond gas, &c." They have issued the Home Office "Memorandum" upon the subject where necessary, and have endeavoured to obtain the adoption of the precautions described. Only three reports of poisoning were received by him. One case, mentioned by Mr. Ireland (Norwich), was due to an escape of water gas in an engine-house in which the power was derived from Dowson gas. A water seal has since been provided to prevent a recurrence; and he advised the provision of an oxygen cylinder. Mr. Gailey (South London) reported respecting a fatal accident which occurred to a night watchman by his falling down a shaft leading to a tunnel in which a sewer was being constructed. The medical evidence showed that the deceased had been poisoned by carbonic oxide and carbonic acid, which appear to have been given off by the coke fire which he had placed in front of his hut. Mr. Pendock (Bristol) gave particulars of a fatal case of poisoning by carbon monoxide which occurred to a man employed in feeding the blast-furnace at an iron-works. He probably either failed to fire the gases after charging the furnace, or neglected to get to the windward side of the furnace opening while the gases were escaping. He was found unconscious; and all artificial means that could be resorted to were unavailing.

Mr. Beaumont says he continued last year to experience difficulty in establishing, in the sulphate of ammonia houses in gas-works, the special rules relating to chemical works; but all objections received from this source were successfully dealt with and withdrawn.

Mr. J. A. Redgrave, reporting upon the Midland division, states that suction-gas plant is making progress; and this is borne out by the reports of several inspectors. At the same time, it is mentioned that the gas companies are competing with this form of installation in the Black Country. Under the head of "Ventilation," he says the introduction of flueless gas and oil stoves is giving some trouble, as shown by the following memorandum on the subject by Mr. Duckering:—

> In a very large number of workrooms, heating is now done by means of gas-heated radiators. Essentially these consist of a series of gas-burners, over which are columns of iron. The iron abstracts a certain amount of heat from the products of combustion, and gives it out again to the atmosphere. The products of combustion, after passing through or over the iron columns, escape into the atmosphere. The claim is apparently made by the makers that they consume all deleterious products. Indeed, many occupiers have asserted that in these stoves there are no products of combustion except water; and they claim this to be the makers' statement. It is also claimed that they are far more economical than any other form of heating. It is difficult to know what is meant by the claim put forward; but, of course, the products of combustion are carbon dioxide and water, and these are not in any sense consumed, but pass into the atmosphere, and, moreover, vitiate the air. This fact is really one of the chief reasons why the stoves are economical, since the heated gases escape and mingle with the air instead of, as in a coal-fire, escaping up the chimney.
>
> What, in effect, happens is that the economy in heat production is obtained at the expense of vitiation of the atmosphere. Even supposing that carbon dioxide is not in itself directly productive of harmful effects—and opinion on this point varies—the large quantity produced in the gas-stoves will displace a corresponding amount of air. It is very questionable, if the atmosphere of a room heated by one of these stoves were maintained by means of ventilation at the same degree of purity as results from some less objectionable form of heating, whether the superior economy would not be on the side of the older form of heating by means of hot pipes. The same remarks apply to the small oil-stoves now so largely used. They undoubtedly very rapidly raise the temperature of a room to a comfortable point; but it is because the air is displaced by the hot products of combustion—*i.e.*, carbon dioxide and water. For years past the practice of lighting gas-burners for purposes of heating has been declaimed against; and there seems little reason in allowing a similar practice to grow up merely because the gas-flame is hidden inside an iron tube. Tests in some factories where these stoves were used, by means of Haldane's apparatus, showed the presence of an abnormal amount of carbon dioxide, varying from 13 to 28 parts per 10,000, compared with 4 to 8 parts per 10,000 found in similar factories heated by a method not allowing the escape of the products of combustion into the atmosphere.

Mr. Sedgwick (Leicester) has faith in ordinary methods. He says he is strongly of opinion that if the workers could only be induced to make the best possible use of the present means intended for the entrance of fresh air and the exit of foul air, the evils arising from breathing in an impure atmosphere would be considerably reduced, if not avoided altogether.

In the report of Mr. J. S. Maitland on the north-eastern division, there is one by Mr. Hine (Leeds) bearing upon gas-works. He says attention was drawn in all gas-works visited to the report on explosions in purifier-houses; and all the managers seemed to be acquainted with the danger. In some cases steps were being taken to improve the ventilation. In one place Mr. Hine found a new house had recently been erected with three sides quite open, and in the old one, in the same works, incandescent gas-lights were fixed in square holes cut through the walls, the insides of which were covered by sheets of glass (all joints being perfectly air-tight), and the burners could only be lighted from the outside. An electric hand lamp was provided in case of need; but at the time of the inspector's visit it had not been called into use. Electric torches have been provided at some works; but they have been discarded as useless, as they so soon become inert. Other inspectors report that the dangers of purifier-houses under certain conditions were pointed out to managers.

Mr. Allhusen (Newcastle) refers to a serious accident, attended with fatal results, which occurred at a factory for the recovery of the commercial products of coal tar—anthracene, naphthalene, &c. The stills were worked in series, and the waste-pipes from all five were connected at the same trough. After all the anthracene had distilled over, the fires were banked for the night, and in the morning the waste tar was run off as usual. Whether the still had been at too high a temperature, or whether (as was suggested at the inquest) the cock was turned full on instead of only half, thus allowing a great mass of the hot tar to escape, is doubtful. But in some way—either from a spark struck by the man's boot on a piece of grit, or from his pipe—the mixed gases from the tar (consisting of anthracene, phenanthrene, and the higher homologues), forming an explosive mixture with the air, ignited, blowing up the waste-pipe, and scattering the hot tar over the attendant.

Mr. John Law (Halifax), referring to the subject of poisoning by carbonic oxide, says the "Memorandum" on this subject was forwarded last year to a number of occupiers, principally those who had adopted suction-gas plants. There was one serious case of carbonic oxide poisoning during the year, in works having a Dowson gas plant. A complaint having been received that girls in an adjoining factory had on occasions to suspend work, and were more or less affected in health, due to an escape of gas, inquiry revealed that the gas plant was the cause. It was situate partly in the open air, under a shelter between two factories, and had a defective gasholder. This latter was made in the ordinary cylindrical form, of thin plates, which had rusted away through exposure to the weather and neglect of painting, so that escape of the gas occurred at the joints and at various parts in the centres of the several sectional plates on the top dome. Attempts to prevent this had been made for some months by thickly covering the holes with moist clay, with coarse sacking and weights laid thereon. These expedients acted only a short time, as the gas bubbled through the wet clay, necessitating frequent renewals daily. It appeared that the attendant had been gassed several times; being once picked up insensible and unable to work for a couple of days on one occasion. The firm's attention was drawn to the danger; but the use of the plant continued. The matter being urgent, Mr. Law applied to the Justices for an interim order under section 17 of the Act. This was subsequently made absolute, and the use of the plant prohibited.

Mr. Hine reports further that, when visiting tar distilleries, it was sometimes found that the whole of the stills were cleaned out at one time, and allowed to stand open for some considerable period before anyone is admitted. Mr. Porteous has had to complain of the absence of oxygen apparatus, and, when provided, of the inability of those on the premises to make use of it. He says the last firm to provide oxygen had occasion to use it within a few days of its purchase, and both the manager and foreman were much impressed with the rapid way in which the man who was overcome by the gas was restored to his senses. The case did not occur at a still, but above a storage tank. Mr. Wilson (Newcastle) says there are now only three tar-distilling works in the district, and the voluntary regulations are carefully observed in each. A painful fatality occurred in one, due to an explosion which liberated hot pitch, and engulphed an attendant before he could escape the boiling stream. The cause of the accident was extremely difficult to diagnose; but it is conjectured that a lighted match must have been dropped in close proximity to an explosive gas. Mr. Dodgson (Sheffield) says special attention was paid to the danger of an incomplete disconnection of the pipes between adjacent stills and the pitch-beds. In only one case did he find a common service-pipe to a range of stills; but he found that the means now adopted in every case thoroughly isolated each still during the operation of cleaning out.

Mr. H. S. Richmond's report on the north-western division contains one by Mr. Eraut (Preston), in the course of which he says he found in one works for producing coal gas in his district adequate ventilating arrangements in the purifier departments. In one, however, where water gas is made for admixture with coal gas, the ventilation in the producer-house was quite inadequate. Dealing with "Ventilation," Mr. Shinner (Liverpool) says that flueless gas or oil stoves are most objectionable; and he has always condemned them wherever he has found them. On the subject of "Industrial Poisoning," Mr. Rogers (Blackburn) says that several cases of gas poisoning (very

probably carbonic acid) occurred in a Burnley weaving-shed last year. The illuminating gas supplied by the Corporation contains varying proportions of carburetted water gas. It was the practice at the shed in question to leave the taps of the burners always open, and to turn the gas on and off at the meter. The operation of lighting took several minutes, and much gas escaped. This practice appears to be very common in most parts of the district. It is said to take twice as long for the overlookers to turn each gas-tap; but the inconvenience is balanced by the saving of gas.

Messrs. Evans and Beard (Liverpool), in common with several other inspectors, report on the dangers attending the use of producer-gas plants. They say the dangerous possibilities of suction-gas plants were brought to their notice early in the year by a fatal accident at Seacombe. The chief danger of gassing appears to be while the blower is in action, as at other times the pressure in the plant is below that of the atmosphere, and any leakage would be inward. Two firms seem to dispense with this blower—substituting a suction fan or a chimney draught between the scrubber and the engine, so that the chance of leakage is considerably diminished. The danger of leakage is greatly intensified where a portion of the gas is taken away by a fan and delivered, under pressure, for lighting or heating purposes. From the experience gained during the year, it would appear that danger from these plants is twofold—from explosion and from poisoning.

Explosion.

1.—By leaving the waste-valve open after starting, so that air drawn in forms an explosive mixture in the scrubber. The possibility of this can be avoided by the use of a three-way cock; but this is not usually done.
2.—By igniting an explosive mixture of gas and air in the pipes when testing the quality of the gas. This caused a serious explosion in Liverpool.
3.—When the engine is also supplied from the town gas supply, there appears to be an additional danger unless a three-way cock is used.

Poisoning.

1.—Air intake through a leaky air valve, or through trying to start the engine with the valves in the wrong position.
2.—From leakage in pipes, scrubbers, or through badly-fitting clinkering-doors or feed-hopper.
3.—By opening drain, test cock, or other orifice, as in the Seacombe accident.
4.—By waste-pipe. In one case this was found discharging into the street about 3 feet from the ground level.
5.—Through the ignition-tube. With tube ignition a small quantity of unburnt gas escapes at every stroke.
6.—Through a leaky engine piston during the compression stroke.
7.—Through the water-seal being forced or empty.
8.—In cleaning the scrubbers. It has been suggested to some occupiers that, before emptying the scrubbers, air should be blown through them for some time by means of the starting-fan; the engine being set on the compression stroke and the gas-valve wedged open.

Whether from any of the above or from other causes not ascertained, it appears certain that men working on these producers do get small amounts of gas, though in many cases not enough to keep them away from work.

Mr. Sumner (Manchester) says he recommends, in connection with suction-gas plants, the fixing of a notice describing the poisonous nature of the gas and the possible danger during the "blow" period; the carrying of the waste-pipe well into the open air and away from windows; and the provision of a small brass test-cock for sampling the quality of the gas, instead of using the waste-pipe for the purpose. Mr. Eraut (Preston) finds these generators located in any convenient situation, frequently without any regard to ventilation. He considers that they should be kept isolated altogether from the factory and the engine-house, and that both the engine-house and the producer-house should be sufficiently ventilated by outlets and inlets. Mr. Shinner (Liverpool) says he has been in communication with three makers of this plant, with the result that they have all issued placard notices for use in engine-rooms, emphasizing the need of caution as to the gas produced, which has no smell, and contains a considerable quantity of carbon monoxide. The running of three plants in basements was objected to, and another, proposed to be installed in a similar position, was abandoned on his recommendation. In another, good mechanical ventilation was insisted upon; and the firm installed two electrically-driven fans on the "Plenum" system. In two other cases of partial basements, exhaust-fans were requested and installed. That great precaution is needed, is shown by four accidents which occurred in the first four months of the year. One fatal accident occurred with producer gas. The firm had been supplied with a copy of the Home Office "Memorandum" on carbon monoxide gas. The man knelt down to attend to a screw-plug below the ground level, and his mate started the fan, blowing the gas into his face. Mr. Shinner also mentions two other accidents from suction producer plants, which fortunately were not accompanied by fatalities. In the one case four men were gassed while using the blower-up fan to restart the engine in a basement cellar. In the other, an explosion occurred of a large main leading from the generator on the roof of a tall building situated in the middle of Liverpool, and large pieces of pipe fell into the public street. The plant was being experimentally run, and no doubt a mixture of air and gas was present in the piping when it was ignited. By extreme good fortune, only one man in the engine-room was slightly injured.

Reporting upon the Scotland and Ireland division, Mr. S. H. Knyvett gives some particulars dealing with the construction, &c., of purifier-houses. The Saltley accident, which, he says, "forms a text for sermons addressed to managers on this point," disclosed the use of lamps with but little, if any, fire-restraining properties, in a building of such construction that any explosion therein could not fail to have accentuated results. Mr. Brothers (Belfast) says that gas-works outside Belfast and Londonderry are not of any magnitude in Ulster, but the managers' attention was drawn last year to the care required in dealing with purifier-houses, and especially to the necessity for these places being as open as possible, that they should have no naked lights about them, and that the safety lamp provided for use in them should be safe in more than name only—these being the main conclusions drawn from Mr. Duckering's reports upon the Saltley and the Coventry explosions. Mr. Buchan (Dundee) states that up to the present he has not come across a purifier-house that is not open on the sides; and he has directed the attention of managers to the need of fixing on certain persons the responsibility of seeing particular things done. He has also recommended the use of electric lamps where light is necessary. At the Dundee Gas-Works, electric lamps are sometimes employed, and also safety lamps; but the latter are invariably tested before use. The need for this was amply demonstrated recently, when a lamp with a very small defect (hardly noticeable) failed to stand the test.

Mr. Young (Glasgow) reports that in all the gas-works recently visited, attention has been drawn to the danger, which is well recognized by every one concerned, of gas explosion in purifier-houses. In the old type of purifier with which the majority of works in his district are equipped, the danger of an explosion similar to that which occurred at Coventry does not exist, as the purifiers are on the ground level, and have no discharge opening in the bottom. The covers, which form the whole top of the purifiers, and which are closed by a water-seal, are removed, and the lime and oxide are shovelled over the edge. It is in the more modern type, which are placed above the ground, and have a hole in the bottom through which the purifying agents are discharged on to the ground or into carts or railway waggons, that such an accident can occur. Nearly all the houses are well ventilated with open sides and louvred roofs; and Mr. Young says it would be impossible, in the event of a leak, for gas to accumulate in the building to any dangerous extent. Several of these houses are lit by lamps let into the walls, which can only be lighted and cleaned from the outside, and in others an electric lamp or safety lamp of proper construction is used when it is necessary for anyone to go into the houses after dark. He points out that the risk of explosion is not confined to the purifier-house, but exists wherever there is a leak in any of the plant placed in a confined space, such as the meter or exhauster house; so that care must be exercised all over gas-works.

The rest of the report consists of the reports of the lady inspectors, the Electrical and Medical Inspectors, the list and text of the orders and certificates of the Secretary of State for the Home Department, departmental memoranda, reports of appeals, and tables.

LYTTELTON (N.Z.) GAS AND WATER SUPPLY.

Mr. G. A. Lewin, the Town Clerk of Lyttelton (N.Z.), has lately submitted to the Mayor and the members of the Municipal Council his report on the work and business in the financial year ending the 31st of March last. We extract from it the following particulars in regard to the gas and water supply.

Mr. Lewin states that steady progress again characterized the operations of the Gas Department in the period covered by his report; the sales of gas by meter showing an increase of 14·18 per cent. on the figures for the preceding year, and a total increase of 97·32 per cent. since the Corporation took over the management of the works. To have practically doubled the output in slightly more than four years, in a concern which for ten or fifteen years had been stationary, Mr. Lewin considers is a result which it is questionable whether the most sanguine advocates of municipal control could have hoped for. During the four years and four months ended the 31st of March last, the sum of £810 was set aside as a sinking fund; £1961 was spent on new works out of revenue; and, in addition, the reductions made to the consumers, on the basis of last year's output, reach the total of £538 per annum. The quantity of coal carbonized was 781 tons, and the gas made was 8,992,000 cubic feet, or at the rate of 11,515 cubic feet per ton; and 8,336,037 cubic feet were sold. Mr. Lewin says it is not claimed that the make per ton is particularly high; but he points out that "high makes are not the beginning and end of gas manufacture." They bring in their wake some counterbalancing disadvantages, one of which is the deposit of naphthalene in the mains and service-pipes. He says it is due to the Manager (Mr. M'Auliffe) to record that this objectionable constituent has never made its appearance. The quantity of coke sold per ton of coal was 7·74 cwt.; and of tar made per ton, 11 42 gallons. The total cost per 1000 cubic feet of gas was 6s. 9·77d.; while the gas sold was equal to 7s. 2·12d., the coke sold to 11·31d., the tar sold to 6·54d.—a total of 8s. 7·97d. The net profit was £882.

With regard to the Water Department, Mr. Lewin says the long, dry summer of 1906, coupled with the largely increased sales to the shipping, had the effect of placing a tax on the supply from the wells greatly in excess of that of any previous year. Early in the summer it became plainly evident that if the Council had not, during the previous year, taken the wise step of sinking new wells, Lyttelton would have suffered a fate similar to that experienced by several other towns in the colony, in which much concern was felt regarding the sufficiency of the supply. The work was happily completed in good time; and all requirements were satisfied. The quantity of water pumped to the main reservoir was 52,483,000 gallons, compared with 44,823,000 gallons in the year 1905-6; and the total consumption was 43,306,880 gallons, or a mean of 29·65 gallons per unit of the population, against 38,637,875 gallons, or 24·94 gallons. The Council have decided to adopt suction-gas plant at the Heathcote Valley pumping-station; but, meanwhile, the best is being done with the present obsolete steam plant. Its limitations, however, are such that Mr. Lewin considers it is not prudent to depend any longer upon it. On the score of economy alone, he mentions that its duty last year was slightly over 16 million foot-pounds per 100 lbs. of coal consumed; whereas that of modern plant, working under analogous conditions, would be anything from 60 to 70 million foot pounds. He adds that the purity of the supply from the wells at Heathcote leaves nothing to be desired.

A new well which has been sunk at the Worthing Water-Works has increased the Company's supply by no less than 900,000 gallons per week; the inflow being considered most satisfactory.

BIRMINGHAM GAS ACCOUNTS.

The detailed accounts prepared by Mr. Thomas H. Clare, the City Treasurer of Birmingham, for the twelve months to March 31, show that the expenditure on revenue account of the gas undertaking was £724,252. Of this amount, coal (including oil, carriage, unloading, and all other expenses of depositing same on works), cost £324,101; purifying materials and wages, £15,767; salaries of engineers and officers at works, £9806; wages at works, £78,104; and repairs, maintenance, and renewal of works, plant, &c. (less old materials sold), £172,019. Under the heading of distribution, salaries of the chief inspector and inspectors and clerks in the light office amounted to £19,262; repairs, maintenance, and renewal of mains and service-pipes, including materials, laying and paving, and labour, to £34,148; and repairing, renewing, and refixing meters, to £8558. Lighting and repairing public lamps cost £3853; rents, rates, and taxes, were £42,968; and the items under management totalled £9787. Under the heading of "Superannuation Scheme, 1897," a sum of £4662 appears; while among the smaller items, bad debts were only responsible for £464. The amount received for gas (less discounts and adjustments), was £687,229; coke and breeze (less labour and cartage), £114,334; tar, £38,462; ammoniacal liquor, £53,661; sundry residual products, £87; rents, £3065; fittings, £2764. Contributions of officers and workmen to the superannuation scheme, 1897, amounted to £1109; and other items brought the total receipts up to £902,850. There was thus a gross balance to carry to the profit and loss account of £178,598, of which £57,563 represented, as stated in the Gas Committee's report (see "JOURNAL," May 21, p. 539), the net profit for the year.

GAS PROFITS AT WARRINGTON.

The minutes of the Gas Committee which were submitted at the last meeting of the Warrington Town Council stated that the balance-sheet of the undertaking showed a sum in hand of £23 251, out of which, after providing for necessary renewals in the works, an amount of £11,000 would be available in aid of the rates.

In moving the adoption of the minutes, Alderman Evans said the Committee were anxious to change the system of dealing with their profits. He gave a history of the gas undertaking since it was acquired by the Corporation, in order to show the troublous times through which it had passed, and the steady increase in the profits during the past few years, which profits had very materially assisted the rates. At the present time, he said, they were faced with the fact that in the near future several renewals and replacements would have to be made. To meet these, the Committee had no available fund; the reserve fund not being applicable, as it must not be used except for the purpose of meeting some unexpected calamity. It, therefore, behoved the Committee, as business men, to make provision to meet the expenditure; so that the whole of the burden would not fall upon one year. The Committee advised that a sufficient sum should from time to time be carried forward on the floating or working balance; so that when the time did come, it would find them prepared to meet the very heavy charge without disorganizing the profits for that particular year, and more especially without affecting the rates, which to a great extent were dependent upon the profit transferred from the gas undertaking. The working balance at present was not sufficient to be drawn upon for any extraordinary expenditure—being only large enough for comfortably working the concern. Indeed, the banking account had been overdrawn for a period during last year. It had been the custom for the last few years, when preparing the estimates for the requirements of the town, to put down a sum as likely to be earned by the gas undertaking. In every case, this had been exceeded. When preparing for the year 1905-6, £10,000 was the amount named; while £14 182 was realized. He did not think it would be disputed, that the transferring of this large sum had considerable influence in deciding the Finance Committee in recommending the reduction of 4d. in the pound on the rates. The amount agreed to for the year 1906-7 was £11,000; while the net amount of profit was found to be £14,701—a record. They had this year a favourable opportunity of commencing such a scheme as he had alluded to. He said "favourable" advisedly, as they were, he believed, on the eve of very strenuous times owing to the increased price of coal and the decrease of revenue, through the recent reduced price of gas. The contracts for coals had just been settled for the year at 2s. 6d. per ton advance, which meant an extra cost of £5000; and the reduction in the price of gas meant a decrease in the revenue of £3000. Consequently, there would be a charge against the year's profits of £8000. Against this, they had only as a set-off the normal increase in the consumption of gas, and what might be an abnormal increase owing to the reduction in price. Therefore all the facts pointed to this being their opportunity; and if they allowed it to go by, they might find it would be a considerable time before they were again in the happy position of having profits in excess of the estimates. It was proposed by the Committee that £11,000 be transferred in reduction of the rates, leaving the balance to be carried forward. In dealing with the profits in this manner, they were following the excellent example of other corporations. St. Helens last year made a profit of £8218, out of which sum £5000 was allocated to the relief of the rates. To his mind, it was wise not to part with all the profits, but retain a sum in prosperous years, which had the effect of more equitably disposing of the profits and increasing the working balance to such an amount as would save them from disaster.

In the course of the subsequent discussion, Mr. Clegg congratulated the Committee, Engineer and Manager (Mr. W. S. Haddock), and rank and file of the Gas Department upon the past year's work. They had made a profit of £23,251, or an increase upon the previous year of £506. This profit had been secured after the reduction of 2d. in the price of gas since last November. He did not think it was the duty of the Committee to ear-mark what profits should be used for. Since the reduction in November, the ratepayers had had a further lowering of 4d. in the rates; but no reduction had been made to slot-meter consumers. He understood there were 8000 slot-meters in Warrington; and those who rented them received no advantage from reductions in the price of gas. The Deputy-Mayor said it was not the time to consider slot-meters or anything else, until coal had got a little cheaper. They had to have a reserve in case of an explosion at the gas-works or some other contingency. Mr. Pemberton remarked that if the resolution meant they were going to set up a new principle, he did not think it was fair. He never dreamt before coming to the meeting there was anything like this in the resolution. It was a big question. Renewals they knew had to come out of profits. But what was the character of the renewals proposed by Alderman Evans? They seemed to be very expensive and heavy. It was a question whether it was not entirely new plant; and they did not want to make present ratepayers pay for something the cost of which should be spread over forty or fifty years. If they wanted to renew the plant, they should borrow the money. Alderman Evans had intimated they wanted a sinking fund. They then commenced to do away with the profits; and they could not relieve the rates to the same extent as before. The ratepayers should enjoy the profits. He did not believe in the present generation paying more than they ought to pay. If the resolution was going to alter the system altogether, they ought to have had notice of it; and he thought it would be well to withdraw the proposal so that they could consider the matter. Alderman Tinnion said the Committee had given the matter careful consideration; and as business men, he thought that what they had in their minds, and what they intended to recommend to the Council, was the proper thing to do. During the last few years they had handed over very large amounts for the reduction of the rates. The sums previous to 1904 were comparatively small. After having put the works on an up-to-date footing in 1903-4, they had a considerable sum available for the reduction of the rates. The 1d. taken off the rates last year, he thought, was a mistake; and it would not have been taken off had it not been for the extraordinary profit shown by the gas undertaking—the whole of it coming out of excessive profits for that year. The Committee did not wish to make a mistake again. In reply to a question, Alderman Evans said the net profit was £14,700, after paying off interest and sinking fund. The Committee proposed to pay out of this £11,000 to the rates, and leave the £3700 as a part of the floating balance.

The minutes were adopted.

SEAFORD GAS PURCHASE QUESTION.

At the recent Monthly Meeting of the Seaford Urban District Council, the following report of a Sub-Committee with regard to the proposed purchase of the gas-works was adopted *nem. con.*

Your Committee have had before them: (1) The Draft Provisional Order promoted by the Seaford Gas Company, Limited, 1907; (2) the report of Messrs. Stevenson and Burstal, MM. Inst. C.E., the Engineers appointed by the Council to advise them thereon; (3) a copy of the objections of the Council lodged with the Board of Trade to the said Provisional Order; (4) the correspondence between the Council and Messrs. Stevenson and Burstal and Messrs. Cooper and Sons, the Parliamentary Agents appointed by the Council; and (5) the return relating to all authorized gas undertakings in the United Kingdom belonging to local authorities for the year ending March 25, 1906.

From the said return, it appears that in England and Wales there are 211 gas undertakings owned by local authorities. In only eight cases the returns show a deficit on the year's working—namely, the Conway Corporation, Rickmansworth Urban District Council, Leigh (Lancs.) Urban District Council, Abergavenny Town Council, Chard Corporation, Burley-in-Wharfedale Urban District Council, Rawmarsh Urban District Council, and Shipley Urban District Council. Though these eight authorities show a deficit in their returns, your Committee do not consider that the loss is a true indication of the state of the affairs of the undertakings. Dealing with them in order: (1) The Conway Corporation, which returned a loss of £309, had had a capital of £22,475, but has repaid £6417 of the capital. During the year covered by the return, £611 was paid for interest and a further £816 off the loans; the repayment on account of loan amounting to 2·64 times the deficit. (2) Rickmansworth, returning a loss of £658, is an undertaking of about the same size, dating from 1903, but having a capital of £39,400. It seems that probably the undertaking was largely over-capitalized. (3) Leigh, with a loss of £2856, is a very much larger undertaking, having a capital of £167,300, of which £11,264 has been repaid and a sinking fund formed amounting to £36,279. During the year covered by the return, £5444 was paid for interest, £678 in further reduction of loan, and £3416 (largely exceeding the returned defici) added to the sinking fund, besides which meters were provided free of charge to 7194 consumers. Oil gas was also manufactured and is included in the returns. (4) Abergavenny, with a deficit of £498, has a capital of £20,120, £3204 has been repaid, and £6786 put to sinking fund. During the year, £527 was paid for interest and £433 added to sinking fund, besides which 252 public lamps were lighted free of charge. (5) Chard, with a loss of £612. This undertaking was under an Order dated 1903. The repaid capital is £1032; and in the year covered by the return paid £1759 interest and £1032 further repayment of loan This being a small concern, a capital of £52,870 seems very excessive. (6) Burley-in-Wharfedale, with a loss of £259, cannot fairly be counted, being only a distributing undertaking in a small area, with a capital of £2749, mostly repaid, and purchasing all the gas sold. (7) Rawmarsh, with a loss of £112, is an undertaking with a capital of £34,117. It had repaid £12,615; and during the year paid £761 in interest and £1316 further repayment of loan, besides supplying meters free to 2230 consumers. (8) Shipley, with a loss of £1411, is a large undertaking. The capital is £316,270, of which they had repaid £45,349, and during the year paid £9936 in interest and £4030 in further repayment of loan. Your Committee consider that these figures prove that gas undertakings in the hands of local authorities are profitable undertakings for the ratepayers; the only probable exceptions being explained by over-capitalization. The price charged is almost without any exception considerably less than that paid in the Seaford

district. Among the purposes to which local authorities have devoted profits are: Relief of rates, reduction in price, deductions from consumers' accounts, public lighting, redemption of loan, contingency, reserve, renewal, sinking funds, general improvement rate, fire brigade, baths, free library account, new council offices, electricity account, and subscription to hospital. The price paid for coal by the various undertakings cannot be ascertained; but the Committee do not consider this (though it would be useful for the purposes of comparison) to be very important, as evidently the price would not be higher to a local authority than to a private company in any particular district.

Nor have the Committee been able to obtain exhaustive information as to private undertakings; but it appears that such undertakings as a rule are very profitable, and that shares in them stand at large premiums in very many cases. There is no gas undertaking owned by a local authority in the County of Sussex; but we are informed that a company carrying on business in a district in Sussex about the size of Seaford some little time since issued a fully paid-up share without payment for each share held by then shareholders, thus doubling the nominal capital; and the latest returns show a dividend of 7 per cent. We are further informed that £5 shares in this undertaking, equivalent to a £2 10s. investment, were recently sold by public auction for upwards of £6.

The existing Company withdrew their application for a Provisional Order, which was opposed by the Council mainly on the ground of excessive capital, on which they asked to be allowed to pay 10 per cent. before the consumers could hope for any advantage by way of reduction of price or otherwise. The Company inserted a clause in the Draft Order enabling the Local Authority to buy, which shows that they were not unwilling sellers; so that their opposition to a purchase by the Local Authority, should such course be decided on, would be confined to the amount to be paid. The price paid on the purchase of gas undertakings is, we understand, mainly based upon the maintainable profits, so that purchasing should prove to be remunerative to the ratepayers.

We are of opinion that the gas undertaking in the hands of the Local Authority, and therefore of the ratepayers, would largely increase, and that it ultimately would become a very valuable asset. The terms for which money can be borrowed for such a purpose extend from five to sixty years; and taking thirty years as an average, the amount required to be paid yearly for each £100 borrowed, including repayment of loan and interest (at, say, 3¾ per cent.), would be £5 12s. 2d. We consider that no more advantageous time to purchase than the present will ever occur. We recommend a purchase of the undertaking at the earliest possible date, and that the Council promote a Bill in Parliament during the next session asking for powers for this purpose. That all necessary steps be at once taken to obtain the consent of the electors to such proceedings. That Messrs. Stevenson and Burstal be retained as Advising Engineers, and Messrs. R. W. Cooper and Sons as Parliamentary Agents.

GAS EXHIBITS AT THE HIGHLAND AND AGRICULTURAL SOCIETY'S SHOW IN EDINBURGH.

The Annual Show of the Highland and Agricultural Society was held in Edinburgh last week. Only a few years ago, search would have been made in vain in such gatherings for exhibits relating to the application of gas for any other than lighting purposes. But year by year the recognition of its suitability for industrial purposes is growing; and on this occasion there were many exhibits which were calculated to bring this fact home to the minds of visitors. For farm work—the driving of threshing and other machines—the oil-engine has the first place, because of the absence of gas supply in remote parts. Since, however, the development of the suction-gas engine, these are coming rapidly forward, for such purposes as the driving of saw-mills, dynamos, and the like, about large establishments. Several suction-gas plants were at work in the exhibition.

The National Gas Engine Company, Limited, had a 22 H.P. engine and another of 11½ H.P. driven by suction gas made on the spot. The Campbell Gas-Engine Company, Limited, of Halifax, also showed two engines, one of 25 H.P. and the other of 18 H.P., running with suction gas. Tangyes Limited had an engine of 43 H.P—a beautiful machine—worked by suction gas. The Carron Company showed a gas-boiler which appeared to be a very handy and efficient appliance.

There was a large display of acetylene-gas plant. Messrs. William Moyes and Sons, of Glasgow, who have fitted up numerous Scotch and Irish lighthouses with acetylene generators and lamps, had a large display, including four generators which are about to be sent to Ireland. The Bon Accord Acetylene Gas Company, of Aberdeen, showed a very effective and safe-working machine; and Messrs. P. & W. M'Lellan, Limited, of Glasgow, in an open-air stand, exhibited a number of appliances for use in connection with railway and other works not under cover—giving lights ranging from 50 up to 2500 candle power; the distinctive name taken by the firm for their goods being the Imperial Automatic Light.

There were quite a number of petrol-gas plants. One shown by Mr. W. S. Gillie, of Edinburgh, was capable of serving 40 lights, and was worked by means of the ordinary town water pressure. Another—an American invention—known as the "Tures Gasoline Light," was exhibited by Mr. A. A. Cruickshank, of Glasgow. This apparatus is worked by putting the petrol under a pressure of about 15 lbs., which forces it through a very small pipe to the burner. The latter portion of the pipe is a tube which passes across the top of the flame, by which means the petrol is gasified. The result is a light of great brilliancy and clearness. A gallon of petrol is said to produce 1000 cubic feet of gas. The Elwell-Smith Petrol Safety Gas Company, Limited, of Edinburgh, had on show two generators, capable of producing gas for either lighting or heating, and also adaptable for the production of gas for power purposes.

Closely allied to gas manufacture as the term is usually understood, and certainly more directly associated with agriculture than any of the other exhibits mentioned, was that which was organized by the Sulphate of Ammonia Committee. On the stand were samples of sulphate from the Alloa Gas Commissioners; the Arbroath Gas Corporation; the Broxburn Oil Company, Limited; the Carnbroe Chemical Company, Limited; the Dalmeny Oil Company, Limited; Messrs. James Dunlop and Company, Limited; the Clyde Iron-Works, Glasgow; the Edinburgh and Leith Gas Commissioners; the Furnace Gases Company, Limited, of Shotts; the Glasgow Iron and Steel Company, Limited; the Langloan Iron and Chemical Company, Limited; Messrs. John Miller and Company, of Aberdeen; the Oakbank Oil Company, Limited; the Perth Gas Commissioners; the Pumpherston Oil Company, Limited; Messrs. James Ross and Company, of Falkirk; the Summerlee Iron Company, Limited; and Young's Paraffin Light and Mineral Oil Company, Limited. There were also on view, for comparison, one or two samples of sulphate from works in England. Besides, there was shown a profusion of produce grown by the aid of sulphate of ammonia, from Dalmeny and other places; some of the specimens being of gigantic proportions, and all of them fresh and healthy looking.

GAS APPLIANCES AT THE IRONMONGERY EXHIBITION.

The Seventh Ironmongery, Hardware, and Allied Trades' Exhibition was opened at the Agricultural Hall, Islington, last Tuesday, by Mr. Charles E. Shaw, in the presence of the President of the Ironmongers' Federated Association (Alderman Cowell, J.P.) and a numerous company. As ironmongers have now become closely connected with the gas industry as sellers of incandescent mantles and cooking and heating stoves, some of the exhibits of this class may be briefly noticed. Commencing with lighting, the Block Light, Limited, make a fine display of their mantles, including the "Junior Block," which, with a consumption of 3 cubic feet of gas per hour, gives about half the light of the standard pattern. Messrs. George Bray and Co., Limited, show three new burners which will shortly be on sale, as well as a varied assortment of their specialities, displayed upon a stall which presents an attractive appearance. Messrs. Henry Hill and Co., Limited, of Nottingham, show mantles of various sizes and textures. The Laddite Incandescent Mantle Company, Limited, furnish evidence that the mantles manufactured by their process are very durable, and produce a light of great brilliancy. The United Kingdom Lighting Trust, Limited, have a fine display of lighting on their high-pressure gas system. Among other lighting appliances, an improved form of pendant gas-fitting is shown by the Hanwell Pendant Company, of Northampton; and a new gas-valve, for controlling at the ceiling the inlet of gas into the flexible metallic tubing of pendants, by the Harquin Pendant Company, of Kentish Town. In heating appliances, the Carron Company's show strikes the visitor on entering the hall. They have on view some examples of fire-grates of the Eighteenth Century, made from patterns produced from original carvings executed at Carron upwards of a hundred years ago. Beyond a coal and gas range, Messrs. Wilsons and Mathiesons, Limited, of Leeds, only show overmantels and registers of various kinds. Among the other exhibitors are the Flavel Range and Imperial Gas-Stoves, Limited, the Non-Explosive Gas Company, Limited, and the Deutsche Continental Gas Gesellschaft, of Dessau. The last-named Company show, through their agents for the United Kingdom (Messrs. Albert Durst and Fränkl), a speciality in the way of laundry irons and gas heater, with tilting stand, as well as geysers, hot-plate cupboards, &c. The exhibition will close next Friday.

Conservation of Welsh Water.

Another conference of the Monmouthshire local authorities was held at Newport last Wednesday, when the question of conserving the Monmouthshire water was further considered. The proceedings were private. At the close of a two hours' sitting, Mr. H. S. Gustrad, the Clerk to the County Council, informed the representatives of the Press that resolutions had been adopted affirming the necessity of conserving the water supply of the county and of promoting a Bill next session to carry out Mr. Baldwin Latham's recommendations. The lines of the Bill would provide that the works should not be commenced until the Council had made such contracts with water distributors (whether companies or local authorities) as would ensure the payment by them of a water-rental not less in the aggregate than the amount of the interest and sinking fund upon the loans to be raised on the security of the county rate to defray the cost of the works and of maintenance and administration; that any water company taking water from the Council should be compelled, under penalties, to supply their whole district under constant pressure; that if the Council supplied any company in bulk, such supply should in no way add to the value of their undertaking on a sale to the local authority; that no water company should be eligible to enter into a contract with the Council to take water in bulk unless they should have first offered, subsequently to the passing of the Bill, to sell by arbitration their undertaking to the local authorities in whose area they held the rights of supply; and that the expenditure to be charged upon the county rate in any one year, exclusive of interest and repayment on the loan for the promotion of the Bill, should not exceed a rate of ½d. in the pound. Mr. Baldwin Latham's report recommended the construction of three large reservoirs on the Grwyne River, on the borders of Breconshire and Monmouthshire, at a cost respectively of £200,000, £250,000, and £280,000. The total cost of the works to supply 4 million gallons of water per day was estimated at £730,000.

At the meeting of the Burton-on-Trent Town Council last Wednesday, it was decided to obtain ten 12-ton waggons from Messrs. S. J. Clay and Co., Limited, and four patent breeze furnaces for boilers from the Victoria Furnace Company. On the same occasion, the Mayor (Alderman T. E. Lowe) announced that they had been able to invest £15,000—a considerable portion of the gas-works reserve fund—at what they considered a favourable time for making investments. They had a balance which allowed sufficient working capital without overdrawing the account at the bank.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I have received from Mr. W. B. M'Lusky, of Perth, a copy of the circular which has been sent out by the Committee who were appointed at the Informal Meeting of Scottish Gas Managers in April last, to formulate a scheme for the commemoration of the work of the late Mr. J. M'Gilchrist, of Dumbarton, in founding and developing the Informal Meeting. In the circular it is stated that a number of proposals have been considered, especially those made at the last Informal Meeting; and the Committee have resolved to give effect to the one submitted by Mr. D. Robertson, of Dunoon—viz., to provide a badge of office to be worn by the Chairman at the Informal Meeting; the retiring Chairman to invest his successor with the badge. The medal is to bear a figure of Mr. M'Gilchrist, a suitable inscription, and illustrative emblems. Ex-Lord Provost MacGregor, of Perth (a jeweller who has been favoured by Royal command), has been asked to design the badge. Subscriptions are solicited. The decision of the Committee is one which will commend itself to the admirers of Mr. M'Gilchrist. It is certainly better than having a yearly medal. When once this medal is provided, the fund may be closed, and the medal will administer itself; but it will be advisable, when the scheme is approved by the Informal Meeting, that instructions be given as to the disposal of the memorial in the event of the Informal Meeting ceasing to be held.

The Edinburgh Town Council had a sort of field day on Tuesday over municipal trading. The subject was introduced by Dr. Robertson, who moved the Council to declare that municipal trading was wrong in principle and detrimental to the interests of the ratepayers generally; and to instruct the representatives of the Council on the Gas Commission to discourage the tendency of the Commission to compete with private traders in making estimates and doing work at or under cost price. Dr. Robertson stated a number of reasons, most of which have done duty before, against the practice. The principal defender of the policy of the Commission was Judge Mallinson, who reminded the Council that the Commission were driven into trading through the traders' neglect of gas-fitting work; and that it was only when the traders saw that the Commission had developed a magnificent business that they wanted it. Dr. Robertson's motion was carried, as against the previous question, by twenty-five votes to twenty-two.

The Hamilton Town Council had before them on Tuesday the report of the Gas Committee upon the year's working. This showed that the quantity of gas made amounted to 154,008,700 cubic feet—an increase upon the previous year of 624,100 cubic feet. The gas sold was 110,216,500 cubic feet—a decrease of 1,496,700 feet. The decrease was accounted for by the use of incandescent burners, as ordinary consumers had increased by 68. The yield of sulphate per ton of coal carbonized was 34·06 lbs., as compared with 33·26 lbs. The accounts showed a profit of £5449; but this included £3768 brought forward from the previous year—leaving the net profit for the past year at £1681. The Gas Committee, by a majority, recommended (1) that £3750 (being £1250 for each of the two preceding years, and a like sum for the past year) be placed, as formerly, to the new municipal buildings account, and the balance of £1699 be carried forward to the current year; and (2) that, in respect of the large increase in the price of coal, the price of gas be increased by 2½d. per 1000 cubic feet, making it 2s. 3½d. for ordinary consumers, and 2s. 1d. for power and lighting, and that the rate for prepayment meters be continued as at present. Bailie Hamilton, the Convener of the Gas Committee, moved approval of these recommendations. Mr. Cassells moved the rejection of the proposal with reference to the new municipal buildings, which gave rise to a discussion, in which Mr. Cassells pointed out that in thirty years the gas-works would be possessed by the community free of debt. The gas-works would then be practically presented to the community by the gas consumers. The recommendation of the Committee was adopted by eleven votes to four. Bailie Hay then moved that the price of gas be not increased. It looked, he said, as if the gas-works were to be made the milch cow of the burgh. Provost Keith argued that the gas consumer was not the same as the ratepayer. The ratepayers were responsible for the gas-works, and were entitled to a reasonable and fair commercial profit upon a commercial business. The average profit they made upon sulphate of ammonia was £1250 a year. It was really from sulphate that they were deriving their profit. They did not propose to raise the price of gas till September, and so the increase for the whole year would be only 1½d., which was not an extravagant rise when they considered that the price of coal had advanced by 3s. per ton. The recommendation of the Committee was adopted by twelve votes to three.

In the Alloa Town Council on Monday, Mr. W. M. Duncanson, the Convener of the Gas Committee, stated that the surplus upon the year ending April 30 was £440, the whole of which had been applied in reducing a deficit of £573 in the Electricity Department. The difference in the price of coal for the current year, as compared with the previous twelve months, was £2121; and, in consequence of this, the Committee recommended that the price of gas be raised from 2s. 2d. to 2s. 6d. per 1000 cubic feet, as from April 30 last. This would bring in an additional sum of £1600, or thereby; and the difference between this and the increased cost of coal would, it was anticipated, be made up by larger returns from coke and sulphate. The Manager—Mr. J. W. Napier—reported that in 1904 the price of gas for lighting was reduced by 2d., and for gas-engines by 4d. per 1000 cubic feet; while last year a differential rate for gas for power purposes was fixed at from 1s. 6d. to 2s. per 1000 cubic feet. The saving to consumers by these reductions amounted, *in cumulo*, to £3537. The sum paid out of the profits by the Gas Department, to meet successive deficits on the electric light, aggregated £2729—an average loss to the Gas Department of £546 per annum. The average price of coal purchased in 1902 was 8s. 7d. per ton; while the average price for the current year was 12s. 7d. The quantity of gas sold in 1902 was 78,847,900 cubic feet, and last year it was 103,243,200 feet—an increase during the past six years of 24,395,300 feet. The advance in the price of gas was agreed to.

In the Broughty Ferry Town Council on Monday, Mr. J. P. Crystal, the Convener of the Gas Committee, said that the deficit of £4500 which stood against the department a few years ago had been wiped out, and they had this year a surplus of £3 7s. 10d. This satisfactory result had been due to their retention of the price of gas at 3s. 6d. They might have cleared off the whole deficit in one year; but this would have necessitated the raising of the price of gas so much that the sale would have been interfered with. During the year the consumption of gas had gone up 2½ million cubic feet; and they were getting better results from the coal than formerly. They had gained £320 on the sale of gas, £100 in coke, and £80 in sulphate of ammonia. They had to provide £900 more for coal; but under all the circumstances they had reason for congratulation, and it would be a satisfaction to the public to learn that they were to reduce the price of gas by 2d. per 1000 cubic feet, and to allow 5 instead of 2½ per cent. discount, for payment within twenty-one days. The accounts were adopted, and the price of gas was reduced as proposed.

The shareholders of the Cupar Gas Company, Limited, met on Thursday—Mr. William Thomson presiding. The Directors reported that, including a balance of £261 from the previous year, there was a sum at the credit of the profit and loss account of £1356. They recommended payment of dividends of 5 per cent. on the preference stock, and of 35s. per share on the ordinary stock; also that the price of gas be advanced by 2½d. per 1000 cubic feet, making it 4s. 2d. The Chairman remarked that the report was a satisfactory one, and showed the Company to be steadily progressing. The increase in the price of gas was due to the ransom prices of coal. At present they were paying something like 25 per cent. more for coal than they did last year. The report was adopted.

The annual meeting of the Stirling Gas Company was held on Tuesday—Mr. J. Johnston in the chair. In moving the adoption of the report of the Directors, the Chairman said they would observe that the new shares were largely over-applied for, the premium on them amounting to £980. New extensions at the works were being carried out satisfactorily, and would be completed in time for the winter work. They would observe, also, that the Company's business was still increasing in every department. The sale of gas for the past year was 106¾ million cubic feet—an increase of nearly 5¾ millions over the previous year, and by far the largest increase they ever had in one year. Consumers had increased by 201; and the increase in gas-cookers was 112, and of grillers 312. There was still a large demand for prepayment meters; the increase last year having been 287, and the amount collected from them £3287—an increase of £761. The residual products had also given satisfactory results. The Directors regretted that they found it necessary to raise the price of gas, but, in the interest of the shareholders, they could not see it to be their duty to act otherwise, if they were to maintain the usual dividend. During the year they lost by death their oldest Director—Mr. Robert Johnston—who had held office for over twenty-five years. They did not propose to fill the vacancy meantime. The report was adopted.

In the Lanark Town Council on Monday, the Town Clerk read a letter from the Secretary to the Lanark Gas Consumers' Company, intimating that the shareholders declined the offer which the Corporation had made for the acquisition of the Company's undertaking. Mr. Graham asked if the Gas Acts applied to coal gas only. There was a town at the present moment being lighted by petrol gas, and the cost to consumers was only 2s. per 1000 cubic feet. The Clerk said he would answer the question at the next meeting of the Council. A letter from the Secretary of the Gas Company was also read, intimating that the Company refused to pay a charge for way-leave for their pipes. The matter was remitted to the Special Committee in connection with the proposed purchase of the gas-works.

The Directors of the Brechin Gas Company, Limited, in their annual report state that there is a credit balance on the year's working of £1109. After allowing a reasonable sum for depreciation, and the payment of dividend on preference shares, a dividend of 7 per cent., free of income-tax, upon the ordinary shares is recommended. This will require £1050; and the balance of £59 will be carried forward, subject to the remuneration of the Directors. It is not proposed to make any increase in the price of gas, notwithstanding the rise in coal.

The Kirriemuir Gaslight Company, Limited, have raised the price of gas by 3d. per 1000 cubic feet, making it 4s. 10d. At a meeting of the Town Council on Tuesday, a motion by Mr. Brooms was adopted, to the effect that the Council take into consideration the advisability of municipalizing the gas-works; and it was remitted to the Lighting Committee to make inquiries and to report.

At the annual meeting of the Jedburgh Gas Company held on Wednesday—Mr. R. B. Balfour presiding—it was reported that the revenue for the year was £1626, of which £1424 was derived from the sale of gas. The expenditure was £1324; and the profit, £302. A dividend at the rate of 6s. per £1 share was paid. Since the introduction of electricity, the burgh burns only £16 worth of gas in a year.

The Duns Gaslight Company held their annual meeting on Tuesday—Mr. Wm. Crawford presiding. A dividend at the rate of 6⅜ per cent. was declared; £150 was added to the reserve fund, raising it to £450; £300 was placed to suspense account, to meet the cost of a new gasholder and other plant; and £120 was carried forward. The price of gas was raised by 5d. per 1000 cubic feet—making it 5s. 5d. for lighting and 4s. 2d. for cooking and heating.

The annual meeting of the Vale of Leven Gas Company, which was converted into a limited liability concern in January last, was held on Monday—Mr. J. Shearer in the chair. A dividend of 5 per cent. was declared; and it was resolved to advance the price of gas from 3s. 6d. to 3s. 9d. per 1000 cubic feet. Owing to the growth of the district, it has been found necessary to extend the retort-house and the purifying plant.

The annual general meeting of the shareholders of the Kelty Gas Company, Limited, was held on Friday of last week. Mr. Henry Rowan, in moving the recommendation of the Directors to pay a dividend of 5 per cent., referred to the excellent results they had attained in the first year of their incorporation. After paying out of revenue all preliminary and legal expenses connected with the institution of the gas-works, a gross profit remained of £497. Interest on debentures absorbed £144, and after paying the dividend a small sum was carried forward. The make of gas for the year was 10,504,000 cubic feet.

There were 1100 consumers at May 31, and gas-stoves have been supplied to 226 consumers. Mr. James Dickson, the Manager, deserves to be congratulated upon the success of his first year's working of a new adventure.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 13.

Sulphate of Ammonia.

The market has been quiet all through the week, there being no special demand at any point. Scotland having entered upon the month with bare stocks, there has been no pressure to sell there; but at other points current production has only been disposed of at slightly lower prices on the week. The closing quotations are consequently £11 15s. per ton f.o.b. Hull, £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. The forward position has been mainly in the hands of speculators, who are taking orders abroad at about the level of spot prices. Meantime makers, who are already well sold ahead, maintain a firm attitude, and are content to stand aside.

Nitrate of Soda.

This article is quiet but steady at 11s. per cwt. for ordinary 95 per cent., and at 11s. 3d. for refined quality, on spot.

LONDON, *July* 13.

Tar Products.

Markets for tar products have been quiet throughout the past week, as is customary at this time of the year. There is really no alteration in the market for pitch. For prompt delivery, though one or two manufacturers would be willing to accept reasonable figures for immediate clearance, there is nothing to be done, as consumers are, of course, unwilling to accept anything during the present hot weather. Prompt values, therefore, are nominal, and may be taken at about 26s. London, 25s. to 25s. 6d. on the east coast, and 23s. 9d. to 24s. 6d. on the west coast. For forward delivery, manufacturers are still very firm in their ideas; but it will probably be a little while before we have any decided buying from the Continent. Creosote remains very firm, though unchanged in price. Small sales continue to be made at about the market quotations, in all directions; but manufacturers would not entertain any very large quantities. Benzol, 90 per cent., is very quiet, and there does not appear to be any demand, whether for this article, 50-90's, or toluol. Consumers of all three are undoubtedly heavily stocked; and it would take a very low offer to tempt them to purchase. Solvent naphtha is still quiet in the North, where sales are reported to have taken place at under 1s. a gallon. In London, it is steady; and there is no great quantity of actual London makes available. Crude carbolic remains in about the same position. Continental consumers refuse to offer more than 1s. 7½d. at east coast ports, except at ports where there are special facilities regarding freights. Crystals are without interest, and no large transactions have been reported for some time past. Sales of tar continue to be made all over the country at about existing figures.

The average values during the week were: Tar, 16s. to 20s. Pitch, London, 26s. nominal; east coast, 25s. 3d. to 25s. 6d.; west coast, 23s. 9d. to 24s. 6d. Benzol, 90 per cent., 7½d. to 8½d.; 50-90 per cent., 8¼d. to 9¼d. Toluol, 10½d. to 11½d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. to 1s. 2½d.; heavy naphtha, 1s. 1½d. to 1s. 3½d. Creosote, London, 2⅞d. to 3d.; North, 2½d. to 2¾d. Heavy oils, 3d. to 3¼d. Carbolic acid, 60 per cent., 1s. 7½d. to 1s. 7¾d. Naphthalene, £6 to £12; salts, 37s. 6d. to 42s. 6d. Anthracene, "A" quality, 1½d. to 1¾d.

Sulphate of Ammonia.

There is really no change in the market for this article. The principal London Gas Companies still maintain their price of £12 2s. 6d. to £12 5s. for January-June; but outside London makes can without doubt be purchased at £11 13s. 9d. to £11 15s. per ton on Beckton terms. In Leith, dealers would probably pay £12 for prompt delivery; but manufacturers will not consider anything under £12 2s. 6d., and for forward they ask £12 5s. In Liverpool, business has been done at £11 16s. 3d. to £11 17s. 6d. for prompt. For forward, £12 has been accepted; but it is not known what quality stuff this was. In Hull, the market may be taken as about £11 13s. 9d. for prompt, and £11 16s. 3d. to £11 17s. 6d. for forward delivery.

Losses on Electrical Power Distribution.—Writing on this subject last Saturday, the "Financial News" said: "Some electric companies engaged in power distribution unhappily lack the power to distribute dividends. The South Wales Electrical Power Distribution Company, which was formed in 1900, and commenced to supply electricity in September, 1902, has not yet paid a dividend. The result of the operations in 1906 was a loss of £22,150, and the debit is increased to £60,978. It is stated that certain proposals will be put before the shareholders at their next meeting with a view to raising further capital.

Gas v. Electricity for Infirmary Lighting.—After discussing the matter at several meetings, the Plymouth Board of Guardians decided last week to accept a tender for the lighting by electricity of a new infirmary they are erecting, but to put in emergency gas-fittings. The tenders for gas and electrical fittings were about the same in amount; the former being £438, against £442 for the latter. The Special Purposes Committee were in favour of the adoption of gas lighting; but their recommendation was opposed on its coming before the Board. Some of the supporters of electric lighting contended that, as the town had embarked on the electricity business, it was the duty of a public body to support it.

Employees' Outings.—The Directors of Meters Limited gave their staff the seventh annual picnic on Saturday, the 6th inst.; the selected place being Whalley. After luncheon, a drive was taken through the interesting neighbourhood. At the conclusion of dinner a vote of thanks was passed to the Directors, which was responded to by Alderman John Miles, J.P., the Chairman of the Company. On the same day, the employees of the Gorleston and Southtown Gas Company had their annual outing at Beccles. In the absence of the Engineer and Manager (Mr. John Witten), Mr. E. F. Keable, his Assistant, presided at dinner, supported by Mr. W. Poll, the foreman. After dinner votes of thanks were passed to the Directors of the Company for their continued liberality, to Mr. Witten for his assistance in arranging for the outing, and to Messrs. Keable and Poll for their services in carrying it out.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 151.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd..	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Feb. 28	14	Bournemouth Gas and Water 10 p.c.	27½—28½	..	4 18 3
51,810	10	,,	7	Do. B 7 p.c.	16⅔—17	..	4 2 4
53,200	10	,,	6	Do. Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	,,	12½	Brentford Consolidated	250—255	..	4 18 1
300,000	,,	,,	9½	Do. New	188—193	..	4 18 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	117—122	..	4 2 0
206,250	,,	June 13	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11½	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8½	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41—43	..	4 13 0
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c.	119—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c.	90—93	..	4 16 9
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	11—11½	..	6 1 9
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	25—27*	+1	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref..	8½—9½	..	4 14 9
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord.	109—111	..	4 10 1
1,443,280	Stk.	,,	5 2/10	Commercial 4 p.c Stk.	105—108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	102—105	..	4 15 3
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk.	103—105	..	3 16 2
486,090	10	Jan. 31	12†	European, Ltd.	23—24	..	5 0 0
354,060	10	,,	12†	Do. £7 10s. paid	18—19	..	4 14 9
15,203,110	Stk.	Feb. 14	4 1/10	Gaslight and Coke 4 p.c. Ord.	95—97	+1	4 10 10
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	88—90	..	3 17 9
3,799,735	,,	,,	4	Do. 4 p.c. Con. Pref.	104—107	+2	3 14 9
4,193,975	,,	June 13	3	Do. 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	171—174	..	4 12 0
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A	221—223	..	4 9 8
718,100	,,	,,	7	Do. B	164—165	..	4 4 10
144,140	Stk.	Feb. 14	7⅝	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb..	100—102	..	4 18 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Feb. 28	4⅝	Newc'tle & G'tesh'd Con.	107—109	..	4 4 10
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	94—95	..	3 13 8
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord.	6¾—7¼	..	4 16 7
796,980	5	Jan. 31	5	Do. 5 p.c. Pref.	5—5¼	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	12½—13	..	6 3 1
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	245—247	..	4 1 0
209,984	,,	,,	10	Do. B	245—247	..	4 1 0
523,500	,,	,,	10	Do. C	245—247	..	4 1 0
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,350,000	Stk.	Feb. 14	5½	South Met., 4 p.c. Ord.	119—121	..	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83*	+½	3 12 3
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	157—159	..	5 0 8
605,000	Stk.	Feb. 28	5½	S'th Suburb'n Ord. 5 p.c.	117—121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	123—126*	+½	3 18 2
502,310	Stk.	May 15	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Feb. 28	6½	Tottenham and Edmonton A 5 p.c.	123—126	..	5 3 2
398,940	,,	,,	5	Do. B 3½ p.c.	100—103	..	4 17 1
137,500	,,	June 27	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	106—108	..	4 12 7
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c.	—	..	—
255,636	,,	,,	6½	Do. B 3½ p.c.	131—136	..	4 15 7
75,000	,,	,,	5⅝	Do. C 3½ p.c.	—	..	—
79,416	,,	June 27	3	Do. 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Feb. 28	5⅛	West Ham 5 p.c. Ord.	102—105	..	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div." † Next dividend will be at this rate.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The general prosperity of the coal trade of the County Palatine continues unbroken. Nearly all the pits are working full time. There is no alteration in prices. Slack is a little more plentiful, in consequence of the holidays taking place first in one part of the county and then in another; and this will go on continuously until the end of September. Prices, however, of this commodity are as firm as ever. There is no slack going into stock, ships taking it away on terms advantageous to coal owners. There is not much delivery just now of gas coal and cannel. With a few exceptions, all contracts for the ensuing twelve months have been arranged at an advance of 2s. 6d. per ton, and in some instances at 3s. Furnace coke, too, is hardening in price, an increase of 6d. per ton having been realized for deliveries during the last two weeks in the present month. There is a good demand just now for coal from Ireland. Four vessels left the Ship Canal last Tuesday laden with coal for Hamburg, Trevor, Falmouth, and Bideford. A new seam of coal has been discovered at the North Pit, Wigan, belonging to the Douglas Bank Colliery Company.

Northern Coal Trade.

The coal trade continues active, and there are now more steamers offering; so that the shipments are fuller than they were, both to the Baltic and to the nearer continental ports. In the steam coal trade, the shipments are now very heavy; and the full production is continued. Best Northumbrians are 14s. 9d. to 15s. per ton f.o.b. For second-class steams, from 14s. to 14s. 3d. is quoted; and for steam smalls, the market is steady at from 10s. to 10s. 3d. In the gas coal trade, there is a very steady demand for this season of the year, more particularly for export; and the collieries are working well to meet the needs. Prices are firm, especially for the best classes of gas coals, and range, for good Durham kinds, from 13s. 6d. to 14s. 6d. per ton f.o.b., with higher quotations for the very best qualities. As to contracts, a few moderate lots have been sold, both for home use and for export. That for the Darlington gas supply is now settled—from 3s. advance being paid generally. A trial is, however, to be made of some Yorkshire coals, which have been offered at a lower price than the Durham collieries quoted; but the question of comparative quality of coal and of the coke are not settled. Other small contracts show steady increases. Coke is firm, and gas coke is in strong demand for export at 17s. per ton f.o.b.; but for household use, lower quotations are made.

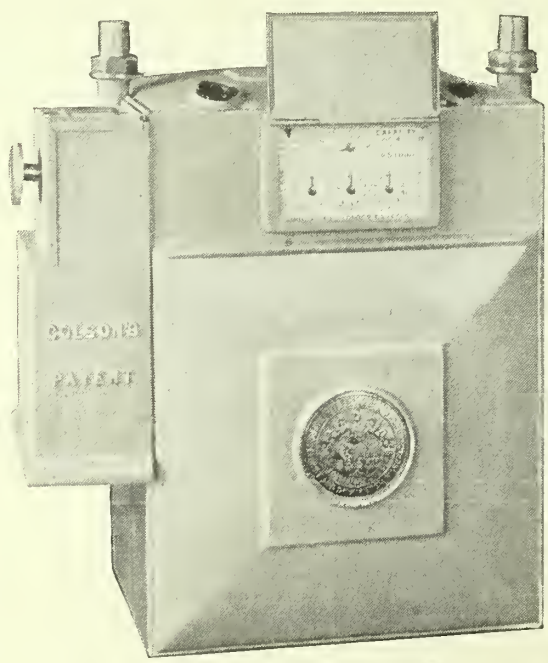
Scotch Coal Trade.

Collieries in Scotland are mostly idle this week, on account of the annual holidays. In anticipation of this there was a big demand last week, with a correspondingly haughty tone on the part of coal owners. Buyers of coal are beginning to fear that the control of the market has got into the hands of a few, who can consequently make their own terms. It is not uncommon, at the present time, to get a tender open for twelve hours only. In this state of matters, prices are rather advancing. The quotations are: Ell 12s. 6d. to 14s. per ton f.o.b. Glasgow, splint 13s. to 13s. 3d., and steam 12s. 3d. to 12s. 6d. The shipments for the week amounted to 338,268 tons—a decrease of 60,058 tons upon the preceding week, but an increase of 54,430 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,391,008 tons—an increase of 445,492 tons upon the corresponding period of 1906.

Railway Companies and the Price of Coal.

A railway correspondent wrote to "The Times" last Thursday as follows: "South Yorkshire coalowners, upon whom several leading Railway Companies have been largely dependent for their supplies, are seeking to obtain so great an advance that the annual contracts for the twelve months ending June 30, 1908, which in ordinary circumstances would have been entered into in the early part of last month, have not yet been signed. The Companies chiefly affected are the Midland, the Great Northern, and the Great Central, and in a less degree the Lancashire and Yorkshire, which can fall back upon the Lancashire coalfields, and the North-Eastern, which has Northumberland and Durham to look to. The price paid under the contracts just expired was 8s. 6d. per ton; and the sum now asked is 12s.—an advance of no less than 3s. 6d. per ton. This Railway Directors most flatly refuse as being ruinous. In the case of the Midland, for instance, the annual consumption is 1,600,000 tons; and it will therefore be seen that an advance of 1s. would mean to them no less than £80,000. The other Companies are proportionately affected. The Midland, the Great Northern, and the Great Central have declared their intention of holding out against the owners' terms; and hence it is that, although it is now July 11, no *modus vivendi* has been arrived at. It is well known that the prices which the Railway Companies pay have an important bearing on the market generally; and, as the present tension is likely to become more acute, other large customers must also suffer. The South Yorkshire owners are acting in concert in the matter, and their representatives, in the course of the negotiations with the Railway Companies, declined to come down—affirming that the demand was so great that 12s. 6d., and even 13s., a ton was obtainable."

The Guildford Town Council have agreed to continue the use of water obtained from the Woking Water Company; the latter allowing the Council £700 per annum out of the gross receipts. The Council will pay interest on the amount of Sir J. Wolfe-Barry's award, at the rate of 4 per cent. per annum from the date of the award. With respect to the extra main, the Corporation will contribute a sum not exceeding £3789.



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THEFT OF CASH FROM
PREPAYMENT METERS.

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THE "WILLEY" METER.

WILLEY & CO., Ltd., LONDON AND EXETER.

The British Coalite Company, Limited.

In the "Financial News" on Monday last week, a correspondent, whose letter was signed "Inner Temple," wrote: "In a letter in your issue of the 28th ult., attention is drawn to the statement in the prospectus of this Company that the patent, for which over £500,000 is asked, is only at the stage of being ready for acceptance. The public are hence unable to know the real nature of the invention, of which they can only buy the equitable rights for this large sum. It is very unusual for large sums to be paid over in any purchase without a good title; and it is to be presumed that the Solicitors will advise the Directors to retain the subscribers' money, as trustees, until a legal title can be given—neither parting with the purchase consideration nor going to allotment until the patent is sealed. In the pamphlet issued by the Company as a reprint of articles from 'The Times,' it is stated that Coalite is protected by letters patent throughout the world. Is this the case? If some of the shareholders ultimately make a loss, will they not have a good cause of action against the Directors?"

Municipal and Private Ownership in America.

According to the Washington Correspondent of "The Times," the National Civic Federation has at last published the first instalment of its report based upon extensive investigations into municipal trading in Europe and America. It contains the views of Mr. J. W. Sullivan, the Editor of a clothing trade journal, and Professor John R. Commons, of the Wisconsin University. They confine their observations to the relations of labour and politics to municipal enterprises. Mr. Sullivan is strongly opposed to the municipalization of public services. Professor Commons, on the other hand, is in the main favourable to it. Both, however, agree that politics are the key to the whole question of municipal ownership and control, and that the recognition of organized labour by the authorities is the surest way to eliminate it therefrom. The extension of municipalization is nevertheless, in Mr. Sullivan's opinion, a menace to Trade Unions, inasmuch as these are tempted to become political clubs (to the perversion of genuine Unionism) in the hands of pernicious labour politicians. Mr. Sullivan finds indications of a turn of the tide in practical municipalization, and he attributes it to disillusionment. Some of the United States municipalized enterprises visited were rich in significant facts relating to politics rather than to labour. Mr. Sullivan, moreover, found conclusive evidence of thorough political rottenness in Syracuse, Allegheny, and Wheeling; and Professor Commons thinks that neither municipal nor private ownership has accomplished in the United States the good results expected. Both, indeed, are outdistanced by somewhat similar ventures in Great Britain.

The Steyning West Rural District Council have decided to approach the Steyning Water Company, with the object of ascertaining what price they would be willing to accept for their undertaking.

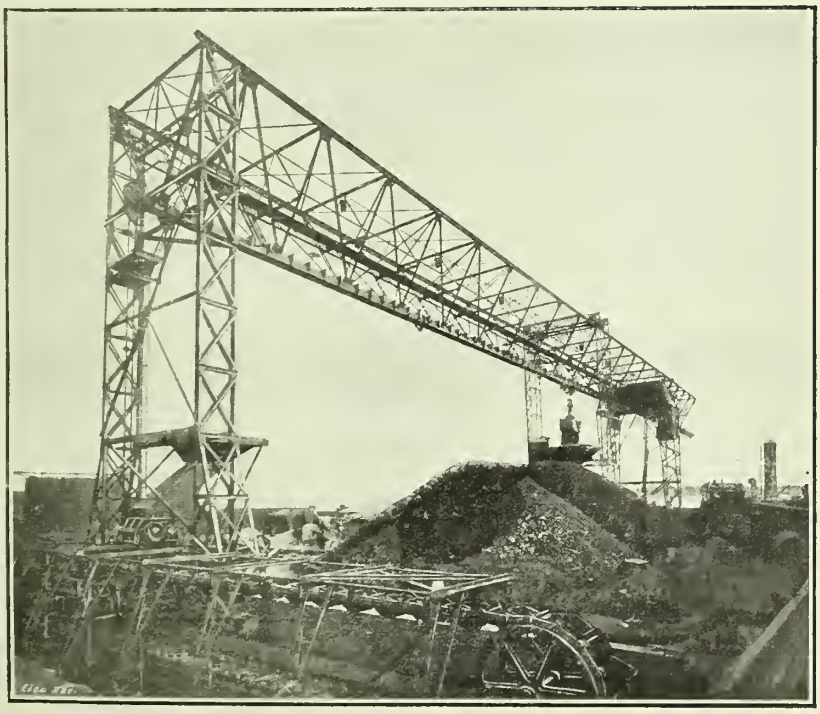
Conway and Colwyn Bay Water Board.—The Conway and Colwyn Bay Joint Water Board have held a meeting to consider a request from the Colwyn Bay Urban District Council that a new main should be laid for the supply of their district; and also to discuss the powers and position of the Board generally. After hearing the opinion of Mr. R. S. Chamberlain, their Solicitor, the Board unanimously decided to apply to Parliament for increased powers as to Cowlyd Lake.

Rhyl Electricity Undertaking.—At the last meeting of the Rhyl Urban District Council, the Electric Lighting Committee suggested the borrowing of £1800 for the purpose of improving the works. The Chairman (Mr. Frimston) said the plant was too large; and it was estimated that they would save a great deal of money on labour alone. Mr. Ellis asked whether they had not better hire the works out to a private individual. A special meeting of the Council, it was agreed, should consider the matter in Committee.

The New Filter-Beds for Loughborough.—In the "Journal" last week, reference was made to the formal opening of the new filter-beds and pure-water tank at the Nanpantan works of the Loughborough Corporation, forming part of a complete scheme which the Engineers (Messrs. G. & F. W. Hodson, MM.Inst.C.E., of Loughborough) had advised the Corporation would have to be taken in hand from time to time as the growth of the district made larger demands upon the excellent supply now available from the Blackbrook reservoir. In addition to the particulars already given, it may be mentioned that the filters and tank have been constructed of 5 to 1 cement concrete, the walls coped with moulded concrete coping-stones made on the site, and the concrete roof of the tank is carried on steel columns and girders encased in concrete. The filtering medium used is Leighton Buzzard sand.

The Gas Question in New York.—Our readers are aware that the question of the price to be charged for gas in New York has been the subject of a long investigation by Master Masten, whose report, accompanied by fourteen volumes of evidence, was filed with the United States Circuit Court on the 24th ult. It may be remembered that the price was fixed by law at 80 c. per 1000 cubic feet. This was objected to, and the old figure of $1 has been continued, and the difference paid into Court pending a decision in the legal proceedings. It is expected that this will not be obtained for at least twelve months from now, by which time the deposit will amount to about $8,000,000. According to a telegram which reached London through Reuter's Agency on Friday, the position has been further complicated by the Attorney-General (Mr. Jackson) announcing that he has commenced a new action against the Consolidated Gas Company with a view to restraining them from exercising certain of the franchises of their constituent Companies which are alleged to have expired. Mr. Jackson applied to the Supreme Court on the 3rd ult. for permission to commence proceedings in order to obtain a judgment nullifying the Charter, and thereby terminating the corporate existence of the Company. The grounds on which the action is based are that the franchises under which the Company have been operating were not legally conferred, and were in violation of laws prohibiting combinations to create a monopoly.

TEMPERLEY TRANSPORTERS



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HANDLING OF COAL & COKE

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BY MEANS OF GRABS OR PATENT AUTOMATIC DUMPING BUCKETS.

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NO BREAKAGE OF COKE if you use Temperley Transporters.

Gas Explosion in Birmingham.—A house in Birmingham was severely, and some persons slightly, injured by a gas explosion last Friday. Employees from the Gas Department were on the premises remedying a defect in the supply when the accident happened—as a result, it is thought, of one of the men striking a match near the meter. It was not found necessary to detain anyone in the hospital.

Swadlincote Gas-Works Management.—Mr. George B. Smedley, the Manager of the Swadlincote Urban District Council Gas-Works, has little reason to be other than well satisfied with the discussion that took place on a resolution that he should receive three months' notice to determine his agreement, unless he consented to accept a reduced salary of £200, instead of the £250 a year he is now having. The proposer urged that the accounts of the gas-works did not meet with general satisfaction, and the management was not all that it should be. Other members, however, spoke in the highest terms of the work Mr. Smedley has done for the Council; and one speaker stated that the motion was "but a thinly disguised attack upon the Lighting Committee," and characterized it as a "mean, dirty, miserable action." In the result, the resolution was lost by ten votes to five.

Saltash Water Supply.—It was decided at a meeting of the Saltash Town Council last Tuesday to approve of a draft agreement with the Great Western Railway Company for the laying of a water-pipe across the Royal Albert Bridge. The supply is derived from Plymouth; mains being carried across the bed of the Hamoaze. In consequence of the difficulty of preventing breakages, it is proposed to substitute for the present mains 5-inch pipes laid across the bridge. The Railway Company's conditions included the payment of £25 yearly for easements, and compensation for damage. The Company will not be responsible for any injury to the pipes. The Water Committee recommended that Mr. H. Bulteel be authorized to test three lengths of the pipes over the bridge at 400 lbs. pressure, at an estimated cost of £20. Mr. Thorne expressed the opinion that the test would not justify the expense. Mr. Widdecombe, on the other hand, thought this a wise precaution; for while Mr. Bulteel would guarantee that the pipes would stand the pressure, he would not guarantee that they would keep tight with the different kinds of vibration on the bridge.

Payment of Wages Out of Loans.—In the course of an inquiry, recently held by Mr. R. H. Bicknell, M.Inst.C.E., in the Leyton Town Hall, respecting an application to the Local Government Board for authority to borrow £5770 for the electricity undertaking, the Electric Lighting Engineer to the District Council (Mr. F. Harman Lewis) stated that a large part of the money would be absorbed in wages, which it was intended to pay out of the loan. The Inspector remarked that where men were specially employed in laying the mains, their wages could properly be apportioned out of the loan; but if permanent officials were to be engaged on the work, their wages must come out of revenue. The Clerk (Mr. R. Vincent) said it appeared to him that if the work was advertised and carried out by a contractor, the wages could come out of the loan; but if it was carried out by the permanent staff of the Council, their wages must be paid out of revenue. The only way out of the difficulty was for those who were accustomed to the work to be discharged and re-engaged for the special work, and after its completion reappointed to the staff again. The Clerk added that he did not see why the Local Government Board could not obviate this. The Inspector said it was their practice.

Water Charges at Plymouth.—A resolution was adopted by the Plymouth Town Council last Tuesday directing the Water Committee to bring up a report as to the rates charged for water for other than domestic purposes, with a view, if thought desirable, to their revision and adjustment before the next financial year. Mr. Pengelly, who moved the resolution, contended that the present charges were unjust to certain consumers. Small hairdressers, for instance, were charged a guinea a year; while lodging-house keepers, who used a hundred times more water, got off with 5s. A number of the trade charges ought to come under the head of domestic charges. Mr. Tozer, the Chairman of the Water Committee, said the Water Engineer reported on the charges in 1904 and 1905; and there was no necessity for a change. Mr. Johnson pointed out that in 1903 the income of the water-works was £30,000 from the sale of 5,839,000 gallons of water; while last year it was £32,000, with a consumption of 5,574,000 gallons. They were supplying less water and getting an extraordinarily larger amount of profit. For a business undertaking this was right enough; but it was not right that the profit should be unfairly dragged out of the ratepayers, and that one class should be treated unfairly as compared with another. The resolution was carried by 23 votes to 5.

Loans for the Devonport Gas and Water Works.—The Devonport Town Council last Thursday unanimously adopted a recommendation of the Gas Committee that application should be made to the Local Government Board for sanction to borrow £25,000, which the Committee estimate will be required during the next three years for the purchase of gas stoves, meters, and automatic installations. Mr. Hornbrook, the Chairman of the Committee, explained that this loan was the result of the growth of the business which they were doing. They kept a shop, and it was empty. The Local Government Board granted them a loan of £35,000 three years ago, and told them to come again if they wanted more when this was expended. He was delighted to tell the Council they had spent every farthing. All the articles sold or fitted up brought in a revenue. The more they spent, the better they were doing. They would not use the money until the demand was made. The Council also decided, on the recommendation of the Water Committee, to apply for a loan of £8000 for new trunk and other mains. This was one of the provisions of the Water Bill recently promoted by the Corporation; but it was struck out by the Police and Sanitary Committee of the House of Commons, who said that application for the loan ought to be made to the Local Government Board.

Mr. W. O. E. Meade King, M.Inst.C.E., conducted a Local Government Board inquiry at the Town Hall, Abergavenny, last Wednesday into an application by the Corporation to borrow £1000 for gas-works purposes. There was no opposition.

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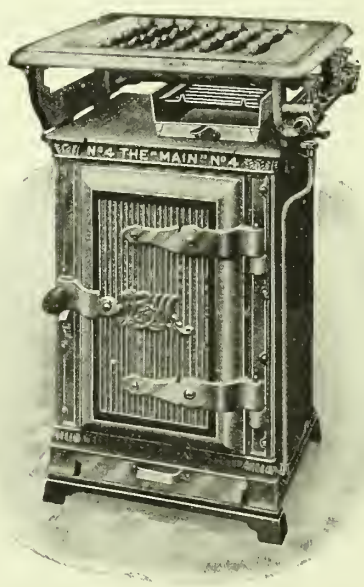

R. & A. MAIN, LTD.,
LONDON & GLASGOW.

At the Royal Hotel, Truro, last Tuesday, Mr. John Winn sold £187 of ordinary stock of the Truro Gas Company at par.

The Gas Committee of the Manchester Corporation last Friday received the sanction of the Local Government Board to borrow £500,000 for gas-works extension.

Messrs. F. & C. Osler's premises at Birmingham, and Oxford Street, London, will be closed on Saturday next, as the centenary of the foundation of the business is to be celebrated by the employees on that day.

An effort, says the "South Wales Daily News," is being made to form a Company for the erection of gas-works to supply Gowerton, Gorseinon, and Loughor. A site has been secured close to the Elba Steel Works.

The Lowestoft Water and Gas Company have informed the Town Council that, in consequence of the greater cost of coal, their charge must be £1 13s. 9d. per lamp, as against £1 11s. 6d. last year; while the price of gas used for other purposes will be raised in proportion.

The Simplex Industrial Producer-Gas Plants, Limited, has been registered with a capital of £600, in £1 shares, to acquire from C. H. Schill the benefit of certain existing inventions and processes relating to gas-producer, hydrogen-gas, and suction-gas plants, and the working thereof, and to adopt an agreement with Messrs. Schill, Aveyard, Denton, and Rowland. There will be no initial public issue.

"Electric light cut off?" said Judge Willis at the Greenwich County Court last Friday. "I should regard that as a blessing. Candles are good enough for me."

A burst occurred at New Mills last Thursday in the new 27-inch main running from Kinder to Stockport. A considerable amount of flooding of cellars and living rooms of houses resulted; but within ten minutes of the occurrence, the flow of water was stopped. The ground subsided over the burst; but as the main at this point is laid on one side of the thoroughfare, traffic was not completely blocked.

The General Manager of the Rhymney and Aber Valleys Gas and Water Company (Mr. A. W. Bransom) has written to John Wright and Eagle Range, Limited, that the exhibition they lately held, under the auspices of the Company, at Caerphilly and Pontlottyn proved very successful. Miss Miles gave lectures twice daily, and the halls in both towns were filled; the result being that a large number of orders were booked for cookers and slot installations.

The Swadlincote Gas Committee asked the Urban District Council at their last meeting to authorize the negotiation of a £5000 loan, to defray the cost of extending the mains to an undeveloped district, and expenditure already met out of revenue which properly should have been charged to capital account. To this, strong opposition was forthcoming; but after the Chairman of the Committee had announced that they would all resign their positions if their recommendation was not adopted, the loan was authorized on the Chairman's casting-vote.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GENERAL MANAGER. British Coalite Company, Limited.
CHEMIST, WORKS MANAGER OR MANAGERESS, SALES MANAGER, AND SALES AGENTS. British Cerofirm Company.
GAS ENGINEER AND MANAGER. Morecambe Corporation. Applications by July 25.
SECRETARY. British Coalite Company, Limited.
GAS MANAGER. No. 4794.
WORKS FOREMAN. Saltley Gas-Works.

Plant (Second-Hand), &c., for Sale.

ENGINE AND EXHAUSTER, METERS, &c. Widnes Gas Department.
PURIFIERS, &c. Galston Gas-Works.
STATION METER. Whittington Gas-Works.

Plant (Second-Hand) Wanted.

SCRUBBERS AND WASHERS. "Gas-Works," c/o Vickers.

Company Meetings.

TOTTENHAM AND EDMONTON GAS COMPANY. Works. Aug. 10. 3.30 o'clock.
WEST HAM GAS COMPANY. Liverpool Street Hotel. Aug. 7. 12.30 o'clock.

Stocks and Shares.

UXBRIDGE GAS COMPANY. July 17.

TENDERS FOR

Coal and Cannel.

BURTON LATIMER GAS COMPANY. Tenders by July 24.
EAST RETFORD GAS DEPARTMENT. Tenders by Aug. 3.
STRATFORD-ON-AVON GAS DEPARTMENT. Tenders by Aug. 17.

Engine and Exhauster.

RHONDDA URBAN DISTRICT COUNCIL. Tenders by July 19.

Gas-Fire Fuel.

Tenders to No. 4796.

Oxide of Iron (Spent).

AIRDRIE GAS-WORKS.

Pipelaying.

HERTS AND ESSEX WATER COMPANY. Tenders by July 23.

Waste Preventers.

MISTLEY WATER-WORKS.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE,

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
Telegrams:—
"BRADNOCK, OLDHAM," and "METRIQUE, LONDON."

BENZOL
AND
CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.

For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.,
7, BISHOPSGATE STREET WITHOUT,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

OXIDE OF IRON.
(NATURAL.)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS
BALE & CHURCH,
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

BY adopting Cripps's Bye-Pass Valves inside your Purifiers, you can relieve the Back-Pressure in the Lower Tiers when the Purifying Material gets hard. They are extremely useful and economical.
Sole Makers: C. & W. WALKER, LIMITED, Midland Iron Works, Donnington, near Newport, SHROPSHIRE.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

PATENTS AND TRADE MARKS PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
Joseph Taylor and Co., Central Plumbing Works Bolton.
Telegrams: Saturators, Bolton. Telephone 0848.

GAS OILS.

MEADE-KING, ROBINSON, & CO. Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, Exchange Street, Manchester, and 11, Old Hall Street, Liverpool.

THE KEITH LIGHT.

4000 INSTALLATIONS NOW IN USE.

SEE illustrated advertisement in next week's issue.

James Keith and Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.

GAZINE—A radical Solvent and Preventative of Naphthalene deposits, and the Automatic cleaning of Mains and Services.
It is also used for the Enrichment of Gas, and has an illuminating value double that of 90 per cent. Benzol.
Supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agent, F. J. Nicol, Pilgrim Street Chambers, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. Blakeley, Gas Engineer, Thornhill, Dewsbury.

BRISTOL RECORDING GAUGES AND THERMOMETERS.

J. W. & C. J. PHILLIPS, 23, College Hill, London, E.C., and 7, Park Square, Leeds.

GAS TAR wanted.
Brotherton and Co., Ltd., Tar Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Wakefield, and Sunderland.

INCREASE YOUR MAKE.

SEND for Particulars of the "RAPID" Carburettor. Why be short of Gas when you can stretch the make from 1000 to 2000 cubic feet per ton, without any difficulty?
Biggs, Wall, & Co., 13, Cross Street, Finsbury Pavement, London.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
Brotherton and Co., Ltd., Chemical Manufacturers. Works: Birmingham, Leeds, Wakefield, and Sunderland.

"VITERNUS" METALLIC PAINT FOR GAS-WORKS PLANT.

JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
Telegrams: "Enamel." National Telephone 1759.

DELLWIK-FLEISCHER WATER GAS.

BLUE WATER GAS, CARBURETTED WATER GAS, SELF-CARBURETTING.

FOR list of towns in which Plant has been Installed, see advertisement in the "Journal" for June 25 last, p. 881.
The Dellwik-Fleischer Water Gas Syndicate, Belgravia Chambers, 72, Victoria Street, Westminster, London, S.W. Telegraphic Address "Dellwik, London."

STEAM (all Types, all Sizes) Boilers. Vertical, Loco., Cornish, Launch, Field-tube; also AIR RECEIVERS, FEED-WATER HEATERS, CYLINDERS, &c.
Grantham Boiler & Crank Co., Ltd., Grantham.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
Read Holliday and Sons, Ltd., Huddersfield.

THE UNIVERSITY OF LEEDS.

DEPARTMENT OF FUEL AND GAS ENGINEERING.

THE New Building of the above Department WILL BE OPEN for the reception of Students on Oct. 1, 1907.
For Particulars respecting Degree and Diploma Courses in Gas Engineering, see Special Prospectus to be obtained on Application to the Registrar.

RESEARCH FELLOWSHIP.

Applications are invited up to Aug. 10, for an Open Fellowship of £100 per Annum, established by the Institution of Gas Engineers for the encouragement of Research in the Chemistry of Gases and Combustion.
For Particulars, apply to the Registrar.

WANTED, a Gas Manager for a Gas Company (making about 20 Million Cubic feet) in the Midlands.
Apply, by letter, stating Age, and Salary required, to No. 4794, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

BRITISH COALITE COMPANY, LIMITED.

SECRETARYSHIP.

THE Directors are prepared to receive Applications, by letter only, for the Position of SECRETARY. Applicants must have filled a similar Position.
Address, stating Qualifications, Age, Salary, &c., to the Chairman, British Coalite Company, 3, London Wall Buildings, London, E.C.

BRITISH COALITE COMPANY, LIMITED.

GENERAL MANAGER.

THE Directors are prepared to receive Applications, by letter only, for the Position of GENERAL MANAGER. Must be a Practical Engineer, acquainted with Gas and Coke Plant, with sound Commercial and Practical Management Experience. Communications treated confidentially.
Address, stating Qualifications, Age, Salary, &c., to the Chairman, British Coalite Company, 3, London Wall Buildings, London, E.C.

CITY OF BIRMINGHAM.
(Gas Department.)

REQUIRED, a Works Foreman, 8 hour shifts—viz., Ten p.m. till Six a.m. and Two p.m. till Ten p.m., changing over fortnightly. Applicants must have had a good Mechanical Training, be well acquainted with up-to-date Gas-Works Plant and Machinery, and used to Controlling Men. Commencing Salary, £130 per Annum.
References, Age, and all Particulars, to be sent to the undersigned, City Gas-Works, Saltley, Birmingham.
Henry Hack,
Engineer-in-Chief.

MORECAMBE CORPORATION.

GAS ENGINEER AND MANAGER.

THE Council of the Borough of Morecambe require a GAS ENGINEER AND MANAGER to Take Sole Charge of the Morecambe Gas-Works and Undertaking.
He is to enter upon his duties as early as possible.
Salary £150 per Annum, with House, Fuel, Rates, and Gas Free.
Applications, stating Age and Experience (accompanied by *copies* of not more than Three Testimonials), to be sent to me in sealed envelope, endorsed "Gas Manager," on or before the 25th of July, 1907.
Wm. Tilly,
Town Clerk.
Town Hall, Morecambe,
July 9, 1907.

WANTED, Good, Sound, Second-Hand SCRUBBERS and WASHERS, Cast-Iron preferred, both capable of dealing with 50,000 to 100,000 feet daily.
Address "Gas-Works," care of J. W. Vickers and Co., 5, Nicholas Lane, E.C.

FOR SALE—A Station Meter, in very good Condition. Was thoroughly Overhauled and Repaired by the Makers Five years ago. Capable of passing 4000 feet per hour. Six-inch Valves and Connections, with Cradle complete.
Apply to the Manager, Gas-Works, Old Whittington, near Chesterfield.

OXIDE of Iron (spent)—About 80 Tons for Disposal for Cash, or new Material in exchange.
Offers, marked "Oxide," to David Vass, Gas-Works, Airdrie.

THE Widnes Corporation Gas Department have FOR SALE the following:—
40,000 cubic feet per hour Combined STEAM-ENGINE and EXHAUSTER (Donkin).
200 2-Light Wet Ordinary METERS, in Cast-Iron Cases.
300 2-Light Wet Slot METERS, in cast-Iron Cases (by Braddock, Orme, and Alder and Mackay).
The Plant and Meters, which are in excellent condition, may be inspected, and any further Particulars obtained, on application to the Manager, Gas-Works, Widnes.

FOR SALE, Three Purifiers—Two of them 10 ft. by 6 ft. by 3 ft. 6 in. and One 9 ft. by 9 ft. by 3 ft. 6 in., with all Connections, in good working order.
Apply to Robert Muir, Manager, Gas-Works, Galston.

WASTE PREVENTERS.

WANTED, Quotation for Supplying WASTE PREVENTERS, in Lots of not less than One Dozen, to comply with following Conditions—viz., capable of containing 2½ Gallons of Water when filled to within 3 inches of the Top.
Send full Particulars to the Secretary, Water-Works, Mistley, Essex.

GAS-FIRE Fuel. Tenders are invited for the Supply of not less than 100,000 pieces, to be taken in a Season. Spot Cash. Selected Tenderers will be invited to submit Samples.
Write No. 4796, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

BURTON LATIMER GAS COMPANY, LIMITED.

TENDERS are invited for 800 Tons of GAS COAL or NUTS, to be delivered as required at the Company's Siding, Isham Station, Midland Railway Company, during the ensuing Twelve Months.
The lowest or any Tender not necessarily accepted.
Tenders, marked "Gas Coal," to be sent in not later than July 24, addressed to the undersigned.
F. T. Freestone,
Secretary.
Alexandra Street,
Burton Latimer, Kettering.

STRATFORD-UPON-AVON CORPORATION.
(Gas Department.)

THE Gas Committee invite Tenders for the Supply of 5000 Tons of Good Screened GAS COAL or NUTS, for delivery during the Twelve Months ending Sept. 30, 1908.
Forms of Tender and other Particulars can be obtained upon Application to the Engineer and Manager.
Tenders to be sent in (and will be accepted only on the Forms supplied) not later than Aug. 17, 1907.
The lowest or any Tender not necessarily accepted.
J. S. Cranmer,
Engineer and Manager.
July, 1907.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the Supply of 7000 Tons of Screened GAS COAL or NUTS to be delivered at the Sidings of the Great Northern or Great Central Railway during the Year ending July 31, 1908.
Forms of Tender may be had, with any further Information, from the undersigned.
Sealed Tenders, endorsed "Tender for Coal," are to be addressed to the Chairman of the Gas Committee on or before the 3rd of August, 1907.
The Committee reserve the right to accept the lowest Tender or any portion of the quantity offered.
J. B. Fenwick,
Engineer and Manager.
Gas and Water Offices,
Grove Street, Retford.

HERTS AND ESSEX WATER-WORKS COMPANY, LIMITED.

TO PIPE-LAYING CONTRACTORS.
Contracts Nos. 5 and 6.

THE Directors of the Herts and Essex Water-Works Company, Limited, are prepared to receive TENDERS for the LAYING of about 4500 Yards of 9-inch, and 5400 Yards of 4-inch and 3-inch internal diameter Cast-Iron Socket PIPES.
The Specification and Plans may be inspected, and Forms of Tender may be had on payment of the sum of Two Guineas, to be returned on receipt of a *bonâ-fide* Tender, on application at the Office of the Company at Harlow, or at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on or after Monday, the 15th day of July; and Tenders must be delivered at the Office of the Company, addressed to the Secretary, at or before Ten o'clock in the Morning of Wednesday, the 23rd day of July, 1907.
The Company do not bind themselves to accept the lowest or any Tender.
William Jones,
Secretary.
Water-Works Office, Harlow,
Essex, July 9, 1907.

RHONDDA URBAN DISTRICT COUNCIL.
(Gas and Water Department.)

NEW HORIZONTAL STEAM-ENGINE AND EXHAUSTER.
Contract No. 45.

THE Council are prepared to receive TENDERS for a HORIZONTAL STEAM-ENGINE and EXHAUSTER to pass 40,000 Cubic Feet of Gas per hour, for their Ystrad Gas-Works.
Plans and Specifications may be seen, and Forms of Tender obtained, upon application to Mr. Octavius Thomas, the Engineer and Manager, Gas and Water Offices, Pentre, Rhondda, upon depositing the sum of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender, but to be forfeited in the case of withdrawal of Tender after acceptance by the Council.
The Contractor will be required to pay the Standard Rate of Wages recognized in the district.
Tenders to be addressed to the Chairman of the Gas and Water Committee, endorsed "Contract No. 45," and delivered at my Office not later than Ten a.m. on Friday, July 19, 1907.
The Council do not bind themselves to accept the lowest or any Tender.
Walter P. Nicholas,
Clerk to the Council.
Public Offices, Pentre,
July 9, 1907.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the ANNUAL ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Gas-Works, Willoughby Lane, Tottenham, on Saturday, the 10th day of August next, at 3.30 o'clock in the afternoon precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ending June 30, 1907; to declare Dividends; to elect Two Directors and an Auditor for the ensuing Year; and to transact General Business.

The TRANSFER BOOKS for the "A" and "B" CONSOLIDATED STOCKS WILL BE CLOSED from July 20 to Aug. 12, both days inclusive.

By order of the Board,
E. TOPLEY,
Secretary.

Chief Offices of the Company:
639, High Road, Tottenham,
July 13, 1907.

WEST HAM GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY MEETING of the Proprietors of this Company will be held at the Abercorn Rooms, Liverpool Street Hotel, E.C. (Bishopsgate Street entrance), on Wednesday, the 7th day of August, 1907, at 12.30 p.m. o'clock precisely, to receive the Report of the Directors and Statement of Accounts for the Half Year ending 30th June, 1907; to declare a Dividend; and for other General Business.

AND

NOTICE IS HEREBY FURTHER GIVEN, that, immediately after the conclusion of the Ordinary Business of the Company, an EXTRAORDINARY MEETING of the Proprietors will be held in order to consider, and, if approved, to pass a Resolution to the following effect, viz.:—

"That the sum of £25,000 Preference Stock, carrying Dividend at the rate of Five per cent. per annum; the sum of £50,000 Consolidated Ordinary Stock; and the sum of £35,000 Four per cent. Perpetual Debenture Stock, be and the same are hereby respectively created in accordance with the provisions of the West Ham Gas Act, 1902; and that the Directors be and they are hereby authorized to issue and allot the said Preference, Consolidated Ordinary, and Debenture Stocks at such times and at such price or prices, and either by tender or auction as they may deem fit, and also out of any premiums received on such allotment to pay brokerage, commissions, and such other expenses as they may consider reasonable and proper."

The TRANSFER BOOKS of the Company, so far as they relate to Consolidated Ordinary and Preference Stocks, WILL BE CLOSED from the 25th of July inst. to the 7th of August next both days inclusive.

By order of the Board,
A. G. SNELGROVE,
Secretary.

Gas-Works, Stratford, E.,
July 16, 1907.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including in these Periodical Sales Gas and Water Stocks and Shares belonging to Private Owners, can be obtained on application to MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
UXBRIDGE GAS COMPANY.

NEW ISSUE OF £6000 CONSOLIDATED STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Wednesday, July 17, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

CASES FOR BINDING
QUARTERLY
VOLUMES OF THE "JOURNAL."
(GREEN CLOTH, GILT LETTERED.)
Price 2s. each.

THE
"ROTARY"
STATION METER.
Efficiency Demonstrated.
APPLY—
T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE, MANCHESTER.

THE BRITISH CEROFIRM COMPANY, LIMITED,

HAVE acquired the rights to the Cerofirm Mantle for Great Britain, its Colonies, and Dependences, and are now prepared to supply it in quantity.

Dr. C. RICHARD BÖHM, one of the greatest authorities on the subject, speaking of the Cerofirm Mantle, says:

"The Incandescent Gaslight Industry may, I consider, heartily congratulate itself. It has scored another immense success—being now capable of producing a Mantle in which the one great drawback of fragility is for ever set aside."

Professor DREHSCHMIDT speaks of it

"As a triumph in the Incandescent Industry."

The Company require the Services of a CHEMIST, WORKS MANAGER or MANAGERESS, and SALES MANAGER.

The Company are also now prepared to appoint SALES AGENTS throughout Great Britain and the Colonies.

Application, in the first instance, to be in writing, with full Details of Experience and Salary required.

Apply to F. L. RAWSON, 26, HART STREET, W.C.

THE
"BLAND"
LIGHT.

Mr. W. R. Herring, M.Inst.C.E., says: "I am happy to be able to report that the results we obtain are fully equal to what is claimed."

For full details respecting this light for Church, Factory, Shop, and Domestic Lighting, write BLAND & CO., 63, Queen Victoria Street, London, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

THE
"BOYS"
CALORIMETER
for determining the calorific value of gases
IS MADE BY
JOHN J. GRIFFIN & SONS,
— LIMITED, —
Makers of Scientific Apparatus,
KINGSWAY, LONDON, W.C.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY,
LONDON OFFICE:
90, CANNON STREET. E.C.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.
LONDON OFFICE: H. CRESSWELL & Co.,
LEADENHALL CHAMBERS, 4, ST. MARY AXE, E.C.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
NEWTONGRANGE, MIDLOTHIAN.

MIDLAND ENAMELLING CO.,
Manufacturers of
DIALS (Enamelled)
For Gas, Water, Electric, &c., Meters.
DIALS
For Pressure Scales in One Length up to 4 feet.
DIALS
For Clocks, Barometers, Thermometer Indicators, and for every purpose.
140, Finch Rd., Handsworth, Birmingham.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

MIRFIELD GAS COAL.
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.
Please apply for Prices, Analyses, and Reports, to the
MIRFIELD (GAS COAL) COLLIERIES
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 22, Park Village East, N.W.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD LONDON, N.
Manufacture and keep in Stock at their Works (also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

ARROL-FOULIS

Patent Automatic Machinery

FOR

DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

GLASGOW.

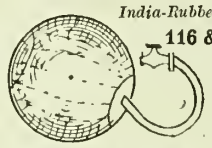
[See Illustrated Advertisement, July 9, p. 132.]

THOMAS BUGDEN,

India-Rubber, Guttapercha, Air-proof, and Waterproof Manufacturer,

116 & 118, GOSWELL ROAD, LONDON.

Tele.: "Airproof, London."

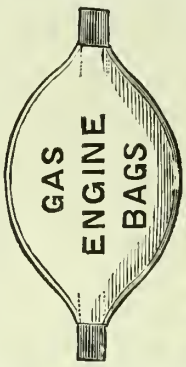


Gas Bags for repairing Mains Round Shape. All Seams Stitched and Taped.

Gas Bags for repairing Mains Cylinder Shape. All Seams Stitched and Taped.

Oilskin Clothing, Diving and Wading Dresses, Sewer Boots, Tar Hose, Stokers' Mitts, Bellows, &c.

Sewer and Fireman's Boots and Stockings.



ORIGINAL MAKER OF

GAS BAGS FOR MAINS.

Contractors' and Miners' Woollen Jackets, Trousers, Hats &c.

Now Ready, a Handsome F'Cap Volume giving a complete account of the

GRANTON GAS-WORKS

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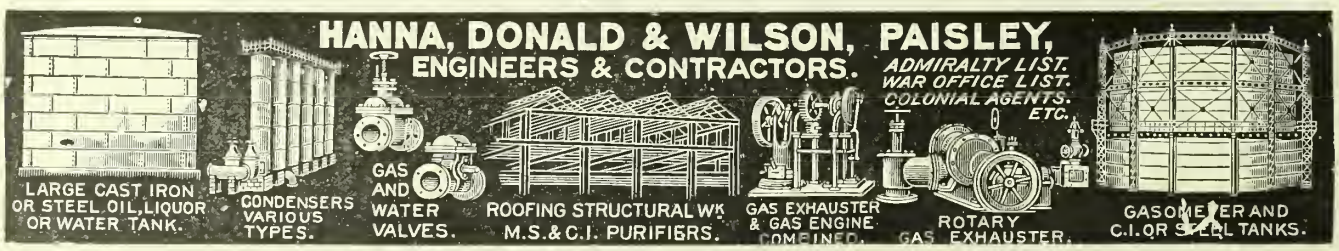

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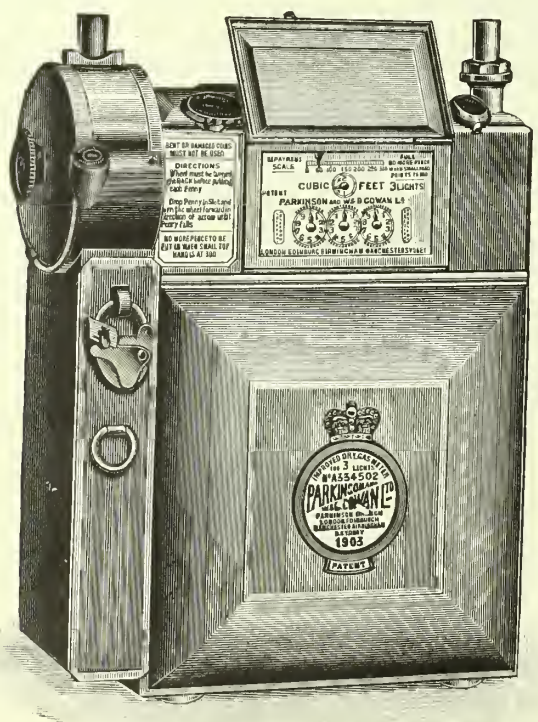

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EDITORIAL NOTES—GAS, &c.

London County Council and Meter-Rents.

IT is a common belief of a section of the community that private companies exercising a public service consider nothing but their own selfish ends. It is a mistake; but if there were real ground for the belief, that ground would serve as the altar upon which selfish interest would be sacrificed. For long years the gas industry of the Metropolis was treated by the late masters in local government with open suspicion, and no good thing could be seen in any act that originated with the Companies. It is therefore with considerable pleasure that we note the, generally speaking, courteous tone that ran through the debate in the County Council on the report of the Public Control Committee dealing with the re-imposition of meter-rents by the Gaslight and Coke Company. The report (as indicated last week) treated of the subject in the practical way that a proposition supported by reasonable considerations, and coming from a body of business men, deserves. Notwithstanding the subsidence from power to impotence of a certain part of the representation in local government in the Metropolis, it was anticipated that the proposal would not go through without a little show of rancour, or (shall we say?) resentment, on the part of the enemies of private enterprise; and from here and there in the Council Chamber, the old note was heard. But it was the old note much weakened by party adversity. It was that the Company had some other motives up their sleeves than those expressed. Crafty and plausible Company! Consumers would suffer; and the Company gain therefrom. So spoke those whose avowals make us doubt whether they know "a hawk from a handsaw." Let us see.

The Company by the agreement in effect concedes a penny of their standard price; there will thus be an absolute necessity for utilizing the revenue from meter-rents in keeping the price of gas a penny lower than it would otherwise be, in order that the dividend may not be affected by the concession; there is the pledge not to raise the price of gas for a twelvemonth; the great body of prepayment consumers (who would have to bear their share of an increase in the price of gas) will not in any wise suffer; and there will be the production of a definite revenue (through re-establishing meter-rents) from thousands of consumers who have meters as stand-bys, or who consume so small a quantity of gas that their custom is hardly worth troubling about, and which revenue spread over the ordinary business will act beneficially to the general body of consumers. In these considerations are concentrated the advantages to the consumers of the restoration of meter-rents. Alderman Anstruther, the Chairman of the Public Control Committee, was right in saying that a permanent benefit, by the course the Company were taking and the arrangement entered into with them, had been secured to the consumers of gas in London. But whose particular interests is Mr. Will Thorne, M.P., seeking to serve in giving notice to raise in the House of Commons this question of meter-rents? Are they those of the small consumers and stand-by meter users of the West-end? If so, Mr. Thorne is proving unfaithful to the trust reposed in him at the last General Election, when labour, the patron of the prepayment meter gas system, carried him on the top of the tide to Westminster. To assist in producing equality between the different classes of gas consumers and so benefit the poorer ones, Mr. Thorne should throw in his lot with the Gaslight and Coke Company (who will be supported by the County Council), when the trial of strength comes with the City over its "favoured nation clause" in regard to meter-rents.

On learning of the successful half-year's business the Company have just closed, there will be some among the critics who will be disposed to question the necessity for rehabilitating the meter-rents; but a few facts should convince them to the contrary. The amount which will be carried forward, after paying the six months' moderate dividend, will be £306,992; but of this £229,953 represents the accumulations brought into the half-year's accounts. The reinstatement of meter-rents will only produce £60,000 a year; and our calculation is that the more expensive raw material the Company will be using in the twelve months from now, will cost them something like an additional quarter-of-a-million. The Company operate in big figures; but an extra outlay of a quarter-of-a-million has to be provided from some source. The Company are really dealing wisely and diplomatically with London in this matter; and they have no ulterior motives, such as were hinted at by one or two narrow-minded County Councillors. The Company's cards are all on the table; and a majority of the Council saw them and their import.

Municipal Trading Accounts.

THE Departmental Committee's inquiry into the question of municipal accountancy has been completed; and, on the whole, the choice made by Mr. John Burns of a Committee to whom reference of the intricate questions involved could be made, has been abundantly justified. There are among the conclusions of the Committee those in which it would be perfectly easy to pick holes. But they are few; and so it follows that, in the main, the report will, if accepted, do much to clear away the crookednesses, contractions, and ambiguities in the fiscal statements and policy of many of our local authorities. This can well be done by the aid of simplification and unification, so far as the latter is possible under the variation of condition. Ratepayers ask for light on their towns' revenues and expenditures; and it is right that they should have it in the purest and strongest form possible. That they have been allowed in all cases the right of knowing how their affairs are managed, the Committee inferentially question through their conclusion that the accounts of municipal authorities are not kept on any uniform system. The Committee are lenient in attributing this condition of things to the vague terminology of Acts of Parliament, insufficiently precise regulations and definitions, and the increasing sense of the inadequacy of the purely cash system of keeping accounts. We cannot, however, hold local authorities altogether blameless in this matter; for Local Government Board inquiries have revealed malversation of a very deliberate character in accountancy, and solely indulged in for the benefit of the trading undertaking concerned. From these and other findings of the Committee, one can readily comprehend why the ratepayers have not found the statements of local finance altogether intelligible, and also why returns—so-called "official" returns—have not been found consistently reliable.

The Committee advise that the most efficient system of account-keeping for general application to local authorities is a system of income and expenditure, on which all incomings and outgoings pertaining to any given period, whether actually received and disbursed or not, are included in the accounts of the period. That conclusion is really the capital one in the report; but it is among the details of the recommendations that amendment must be sought for. The actual scheme of book-keeping must necessarily be adapted to the requirements of the several local authorities; but we do most heartily agree with the Committee that the scheme should be designed to present the accounts of the various transactions through their different stages from first to last in a continuous and coherent connection. The Committee also recommend that separate revenue accounts, net revenue accounts, and balance-sheets should be prepared in respect of all trading undertakings. That, again, is a matter that Parliament has sought to assure in Private Acts referring to these undertakings; but "vague terminology," anything but "precise regulations and definitions," and liberal interpretation have kept open the door to peculiar and irregular allocation of charges as between department and

department. That is a practice against which protection is badly needed. The Committee take a narrow view of the much-disputed question of depreciation. It is agreed that the variable nature of assets precludes the application of any general standard or scale of depreciation. The point on which the Committee will find themselves at variance with expert financiers, but supported by "Progressively" directed Councils, with profitless or next to profitless trading undertakings, and by the gentry who are always in search of something in aid of the rates, will be this: "The repayment "of debt, so far as it goes, may properly be regarded as pro- "vision for depreciation. But it is possible that the period "allowed for repayment may be excessive; and therefore in "some cases further provision for depreciation may be neces- "sary." Though the Committee assert that "repayment of "debt so far as it goes may properly be regarded as provision "for depreciation," we find in all the proffered standard forms of accounts for gas, electricity, water, and tramways accompanying the report, that a renewals fund account is presented. On this question of depreciation or provision for renewals the Committee appear to have tried to avoid the sand-banks raised by past controversy by steering a middle course. These renewals funds are, at the option apparently of a local authority, to have a full or limited application. Within the Committee's knowledge, there are evidently many authorities with plant already scrapped, but the loans for which are undischarged; for it is advised in the report that replacements should be set against revenue or reserve fund in all cases, "except where the original loan "has been discharged, and a further loan sanctioned." Now, if all replacements were charged to a renewals or depreciation fund regularly provided from revenue, ratepayers would not be perpetually engaged in that unprofitable business of working in respect of the same plant on borrowed money, with its continuous burden of interest and sinking fund. The special points submitted by the Committee for the making of regulations are of interest; and it is open to all to subscribe heartily to their deliberate opinion, that the regulations should aim at securing that reliable and uniform principles shall in all cases govern the statement of profit and loss.

As intimated, the Committee append to their report proposed standard forms of accounts for municipal trading concerns. The completeness or otherwise of these cannot be judged by hasty inspection; but so far as the gas-works accounts go, while naturally they follow in their substance the "Model Form of Accounts" appended to the Gas-Works Clauses Act, 1871, there are a few variations apart from those necessitated in conforming the accounts to the needs of local authorities. It will be observed that wages of stokers and of purifying men are set out under the separate employments, instead of being lumped together. But as there are more than stokers and purifying men engaged on a works, we are wondering where, under this specific division, their wages are to be charged up. Another charge quite out of the ordinary, but nevertheless useful on the expenditure side of the account, is "Residual Products—Charges in Connection "Therewith." It is also seen that the payments for gas by municipal departments are to be kept distinct from those of private consumers. We hope that good will ensue from the Committee's labours, by the attainment of those purposes which will give greater satisfaction and confidence in municipal accountancy than exist at the moment. Nothing more important touching this subject has appeared since the Joint Select Committee on Municipal Trading reported in 1903.

Speculative Electricity Charges.

The Incorporated Municipal Electrical Association were partly engaged at their recent meeting at Sheffield in considering a couple of papers bearing upon, but not helping to assuage, the much-vexed question of charging for electricity. We are not going to discuss the papers, but merely refer to the sidelight they and the discussion threw on the subject covered by the title adopted above. The authors of the papers were Mr. H. K. Burnett, of Barrow-in-Furness, and Mr. C. E. C. Shawfield, of Wolverhampton—the one discoursed on "The Relation of Costs to Scales of Charges," and the other on "Cheap Power Supply by Municipalities." The compositions were remarkable—the chief characteristic in one case being the beautifully elementary matter; in the other, the tactless and buoyant spirit in which the author advised that business should be done. But both communications were representative, in an extraordinary manner, of the principles that have guided many electrical engineers in devising their scales of charges. Simple faith, recklessness, and indiscrimination underlie many a tariff of charges for electricity. Mr. Burnett presented considerations, not all acceptable, but some that should be of radical importance in drawing up a tariff; Mr. Shawfield advocated that the element of prudence in business should be scattered to the four-winds, adopting as his maxim "Adjust the tariff to suit the "competition; and the cost of production will adjust itself to "the tariff." Pliant cost of production! Did ever anyone see such a fantastical rule advocated for serious business? The maxim points out the high road to financial disaster. Nevertheless, it is the maxim that, consciously or unconsciously, has been—we have, in addition to our own knowledge, published electrical authority for saying this—adopted in the electrical industry; and if the results have in isolated instances been successful, it has been by sheer good luck, and not because the methods summed up in the maxim comprehend intelligence, commercial aptitude, prudence, foresight, and the ability to direct on commonsense and systematic lines. We would put a shorter maxim alongside Mr. Shawfield's—"Look before you leap;" and consider it in conjunction with Mr. J. F. C. Snell's very practical remarks in the discussion on the papers. Mr. Snell said (quoting the "Electrician" report):

> From his more recent experience of power supply in many large towns, if the tramway load continued to increase, it would not be possible to cover the cost, if supplying at a cheap rate. He thought the tendency was away from many different methods of charging towards a uniform system of initial charge, with graduated scale of discounts. The moral to be drawn from the papers was that the competition with gas for lighting was becoming more keen; and, although there was also power competition, this could be more successfully met. In fixing power tariffs, however, it was *necessary to keep in mind the rapid rate at which the power load was increasing. If this factor were left unconsidered, the power load might preponderate over the lighting, and the revenue account might appear on the wrong side.*

A perfect sermon could be prepared for electrical engineers with Mr. Snell's warning words as the text. There are power loads and power loads. There are large, constant, and long-hour power loads that are worth having, and that have a remarkable influence upon costs generally; there are other loads that are erratic in time and quantity—such as some of the London Companies have taken on—that are not worth having, and that are a burden on the lighting consumers. In some towns the greater part of the power load is built up of such as these. In considering some of the low-priced contracts for power electricity that have come to notice, where the load is dependent on the fluctuations in the demand for the manufacturers' goods, we have marvelled at the boldness of the business-at-any-price engineers. We see no reason why it should not come to pass in some towns for the electrical power business to, as Mr. Snell puts it, preponderate over the lighting business, and the lighting become merely a kind of side-issue to the main or power part of the business. Brighton reports a drop of nearly 78,000 units last year in private consumption—largely (so it is said) due to the high-efficiency electric lamps, and we with all modesty claim that the part of this decline in consumption that is not due to the high-efficiency electricity lamps is attributable to consumers returning to incandescent gas lighting. Should the power business ever swamp the lighting business through the influences acting in both directions, then we shall read some lessons from financial statements which will be the unwelcome product of present speculative and unreasoned fixing of charges.

We are rather surprised to find Mr. S. L. Pearce, of Manchester, ranking himself with those of the speculative school. "There are," he says, "cases in which the authority would "be justified in remitting a portion of the fixed charges for "power consumers; and this would probably be sound policy "for the undertakings as a whole, though it might result in "a loss for a year or two on that particular consumer." It is impossible to subscribe to these unbusinesslike doctrines, especially in connection with a municipal concern. Where there is loss, someone has to bear it, and, in a municipal concern, it is not the management (the management not being the investing principals as in a private concern), and it is not those who lend the capital for the business (they are fully protected). Then it must be those consumers whose custom produces profit; or, if their profit is not in the aggregate equal to the satisfying of the financial obligations of the concern, then the loss resulting from such wanton trading falls on the ratepayers who have not contributed to the making of the loss. That either the profit-making

consumers or ratepayers should bear such loss is an indefensible proposition. The loss, Mr. Pearce lightly suggests, might have a duration of only a year or two; we submit that it might also be perpetual, so long as the particular contract lasted. And such speculation, we hold, ought to be ousted from municipal trading. More of this kind of business is found in Mr. Burnett's reply upon the discussion. "They "could not," he remarked, "help losing over the short-hour "consumers; and they must therefore increase the profits "on the long-hour consumers, or the net result would be on "the wrong side." Well, it is a queer sort of business that penalizes the best consumers for the worst ones; and they must be queer sort of people who manage such business. However, it is a pleasure to see that our electrical contemporaries, in commenting upon the papers, decline to be parties to such uncommercial tactics, and deal with the matter in a more sober spirit than the two authors concerned and some of the participants in the discussion on the papers. We cannot help thinking that, if the Council of the Incorporated Municipal Electrical Association are not desirous of making the administration of the electrical industry the laughing-stock of competitors, they will discountenance such papers as these in future, and adjure their members, when speaking in discussions, to keep in the background certain of the idiosyncrasies of electrical commercialism.

Putting on the Hands of the Clock.

There are schemes which at the first blush strike one as quixotic, but which on further serious consideration may prove theoretically correct and practicable under certain conditions. A scheme propounded by Mr. William Willett, of Sloane Square (which is, however, by no means novel), is one of these; but that scheme has been "laughed to scorn" by the "Westminster Gazette," as the work of a visionary and as absolutely impracticable. The douching of ridicule that our evening contemporary gives the idea amuses, but it has not so much weight as an actual demonstration of practicability. What Mr. Willett proposes is that we should utilize more of Nature's light, and less of the artificial variety by, in April, putting on the hands of the clock for four successive Sunday mornings by twenty minutes; and thus by May we should be rising 80 minutes earlier in the daylight, and be retiring 80 minutes sooner after darkness had set in. Then, on the same instalment principle, he would have us go back to the old times in September. Mr. Willett maintains that in this manner we should obtain the maximum of health, strength, entertainment, and would economize in our use of artificial light. That is where the lighting industries would look askance at the scheme. "Everyone, rich and poor "alike, will find his ordinary expenditure on electric light, "gas, oil, and candles considerably reduced for nearly six "months in every year, so that 210 additional hours of day-"light can be gained, and at least £2,500,000 a year can be "saved to the people of Great Britain and Ireland." The details of this estimate are not available; so that we cannot discuss Mr. Willett on the head of the saving. But however the figure has been arrived at, it can only be a supposititious one.

A very similar, but permanent, project to Mr. Willett's was actually put into force, to the extent of an hour, in Cape Colony a few years ago. People on an appointed day put their clocks on an hour, so (according to the old time) starting the day an hour earlier, and ending business an hour sooner, and retiring to rest at their customary hour by the new time. That it did have an effect on the consumption of gas, though not to the extent that might have been anticipated, was a point in Mr. D. Ford Goddard's address to the shareholders of the South African Lighting Association in 1904. Cape Colony then proved the practicability of the idea. We prove the same thing by the adjustment of our chronometers, and the regulation of our movements to the altered time, on every occasion we visit the Continent or Ireland. The weak point, however, in Mr. Willett's mode of procedure in bringing the alteration to pass is the suggestion of the instalment system. He wants to do the thing gently; but we cannot be chopping and changing about eight times a year, disorganizing business, traffic, industry, and everything else with each change. There would be difficulty in conforming pace and habits to such rapid mutation. If a change is made, it must be once and for good. In the depth of winter, it would really make little difference whether we used artificial light for eighty minutes in the morning, and lessened it by the same time in the evening. The gain would be in the summer months. Such a change would, of course, have to be universal, and Parliament would have to make it compulsory. But Parliament is at present too busy with other matters; and nobody but Mr. Willett seems dissatisfied with the present time regulation of the day's affairs. Therefore, the lighting industries need not fret just yet over a prospective loss of business through the pictured economy of this revolutionary dream.

Liability for Stamp Duty.

The question of the liability of companies to pay an *ad valorem* stamp duty when passing from a non-statutory to statutory estate has been submitted to the arbitrament of Mr. Justice Bray, and he sides with those eminent Counsel who have given their opinion that such liability does exist, although equally eminent Counsel have pronounced the other way. The *pros* and *cons* of the matter have been previously submitted in these columns; and our sympathies have been on the side of the aggrieved companies. The contention of the Commissioners of Inland Revenue is that there is, on the obtaining of an Act of Parliament by a non-statutory company, a vesting of the property of the limited company in the new company "by way of sale," and therefore the provisions of the Finance Act of 1895 apply. On the other hand, it is contended by the companies who have contested the question that the conferment of statutory powers merely raises the status of the existing limited company, and there is no transaction in the nature of a sale—the parties being identical, and not contracting parties. It is purely a question of legal interpretation; and in the King's Bench Division, Mr. Justice Bray is in favour of the Inland Revenue Commissioners. There the matter stands; and no good purpose would be achieved by further discussing the matter here, unless the companies interested are prepared to carry it farther. That they will be prepared to do so is hardly likely, as the additional expense would fall upon them, and, if success attended their efforts, the gain would be that of future non-statutory companies on their incorporation. In the presentation of the matter for adjudication by the Court, the Felixstowe Gas Company have taken a leading part; and in furthering the matter Mr. F. Paternoster, the Company's Engineer and Manager, has been the active mover, with the concurrence of his Board.

Testing Dublin Gas.

After the lapse of some weeks, to enable one of the Divisional Magistrates—Mr. Swifte, K.C.—to consider the evidence submitted to him in connection with three summonses taken out by the Dublin Corporation against the Alliance and Dublin Consumers' Gas Company for supplying gas which was alleged to be below the standard illuminating power, and also to afford him an opportunity of inspecting the gas-testing station, he has delivered his judgment, and the principal points of it will be found in our "Legal Intelligence." In two out of the three cases of alleged deficiency, the Corporation failed to substantiate their charges against the Company, and they were ordered to pay £20 costs in respect of each summons. In the third, the Company admitted that their gas was below the standard, as the result of an accident; and they were fined £1, with £4 costs. The whole case turned, it may be remembered, on the reliability of the tests made by Mr. Thomas J. Cotton, the Official Gas Examiner to the Corporation, which was disputed by the defendants. Seeing that when the late Professor Tichborne, the Gas Examiner under the Board of Trade, tested the gas, his figures were invariably higher than those of the Corporation's Examiner, and that Professor Lewes gave evidence to the effect that the method of testing employed by the latter official was calculated to render his results worthless, the Magistrate had only one course to follow. While acknowledging Mr. Cotton's "great conscientiousness" in the discharge of his duty, Mr. Swifte thought he adhered too rigidly to opinions formed many years ago, and now in some respects superseded. It is to be regretted that before the Company were dragged into a Police Court the evidence to be brought against them was not carefully scrutinized in the light of previous the differences between the Official Gas Examiner and a photometrist of the standing of the late Professor Tichborne, as the Corporation would then have been spared the unpleasantness of hearing Professor Lewes's frank opinion. Another matter for regret is that, in view of the technical nature of the case, the Magistrate could

not have had the assistance of an assessor, as then possibly the inquiry might have been shortened. However, it may be hoped that the relations between the parties may henceforward be such as to require the intervention of neither legal nor technical experts. We are sure this condition of things is heartily desired on the Company's side.

Gas Affairs in Manchester.

Once more the report and accounts of the Manchester Corporation Gas Committee—the usual particulars from which we are, by the courtesy of Mr. Charles Nickson, the Superintendent, able to publish to-day—testify to a highly successful year's working. There has been a considerable expansion in the amount of business done; for the quantity of gas sent out from the works shows an increase of just over 5 per cent. above the preceding twelve months, which in its turn was nearly 6½ per cent. above the year before. In the manufacture there is also an advance of a gratifying character to chronicle, inasmuch as the make of gas per ton is on the present occasion over 100 cubic feet greater—the increase having been from 10,976 to 11,099 cubic fect per ton. The quantity of gas consumed by cookers was last year over 18 per cent. more than in the preceding twelve months; and at the present time about 39 per cent. of the Corporation consumers have the free use of a cooker or griller. Curiously enough, while the number of gas-engines in use has fallen from 1775 to 1732, the amount of gas taken for this purpose shows an increase of about ½ per cent. Cookers now account for a consumption of 504 million cubic feet; and gas-engiues, 416¼ millions. Coming to the financial aspect, it is seen that the net profits have increased from £91,337 to £120,123. The amount handed over to the rates is a few hundred pounds more on this occasion than was the case last year—the contribution being the very round (not to say princely) sum of £60,000. While the income of the department has gone up from £699,566 to £730,902, the expenditure has exhibited quite as gratifying a movement in the other direction—the falling off having been from £566,692 to £564,304. Taking the biggest item of expenditure—coal, cannel, and oil—the cost per ton was very nearly 5d. less than in the preceding twelve months, which, it is pointed out, on the total carbonization of 503,693 tons, amounts to £10,347. For the purpose of the apportionment which the Committee have made, a sum of £8782 has been transferred from the reserve fund and added to the net profit—a very much smaller sum thau was similarly transferred last year, when also the purchase-money for the portion of the Stretford Gas Company's undertaking that was acquired was taken from the reserve.

A Strange Case at Bradford.

Very seldom indeed can it have been the lot of a corporation official to be so severely handled as was a clerk in the legal department of the City of Bradford last week by Mr. Justice Grantham, as the outcome of a case tried at the West Riding Assizes. The action (a report of which will be found in another part of this issue) was one to recover the value of stationery, &c., alleged to have been damaged on the premises of a draper by leakage of water through crevices left round a flagstone which had been raised by the Corporation workmen for the purpose of finding a gas escape, and then loosely put back into position. The evidence given was for the most part of a highly conflicting character; witnesses being called for the defence who said they had seen oue of plaintiff's men himself lifting up the flagstone, and that the plaintiff had purposely caused damage to be done to his stock for the bolstering up of the claim. Thus the Jury were confronted with the plain question of which side was telling the truth; and in the settling of this, material assistance was rendered by Mr. Tindal Atkinson, plaintiff's Counsel, in his cross-examination of two of the witnesses called for the Corporation. Both of the men in question were formerly in the employ of the plaintiff; and each swore that the stock had been tampered with for the purpose of increasing the claim for damage. They were, however, forced to admit in cross-examination that they made statements to plaintiff's Solicitor of conversations they had had with a clerk in the service of the Corporation; and these statements were, as will be seen from the report, of a most extraordinary character—showing, as they did, that the men had been seriously tampered with. This fact it was that led Mr. Tindal Atkinson to give expression to the thought that when the ratepayers of Bradford read an account of the case, "they would blush for shame that such conduct could be pursued by a Corporation official;" and this fact, also, it was that drew from Mr. Justice Grantham a most scathing criticism when summing up the case to the Jury. His Lordship's remarks could not well have been stronger; and the Foreman of the Jury was requested by his colleagues to express their agreement with what had been said. The matter is now under investigation by a Special Sub-Committee of the Finance Committee, who will no doubt probe it to the bottom. Admitting the need for taking every precaution against claims for damages being unduly swelled, still zeal should be tempered by discretion—which, judging from what transpired at the Assizes, has not been the case in the present instance.

Sulphate of Ammonia Committee's Report.

The meeting of the subscribers to the Sulphate of Ammonia Committee has been held; and extracts from the report of the Executive appear in our "Miscellaneous News." The activities of the Committee have not during the past year been lessened. There was, it is true, a diminution in the number of prize competitions; but the cause of this is satisfactorily explained. It is, on the other hand, gratifying to see that special effort has induced 25 other Agricultural Societies who have not hitherto competed to enter the competitions this year. Display was made at several exhibitions; and propagandizing work in other directions has been continued at the same high level as formerly. The representative of the Committee specially appointed for the purpose last year has been doing good service by personal interviews in securing co-operation in developing the sales of sulphate of ammonia. Several new subscribers were obtained during the year; but the report does not tell us the classes of producers these represent—whether for undertakings or otherwise. Tables extracted from the report of the Technical Adviser will show readers the considerable increase in crop yield per acre obtained in the competitions on land receiving a dressing of sulphate of ammonia.

Electrolysis.

Protection of underground pipes against electrolytic action, and the safety of the public, are obviously matters of small moment to the Lord Chairman of Committees. His Lordship is the impassable barrier in this matter. Although there may be agreement between promoters of electricity measures and pipe owners, and although the Commons may grant protection, Lord Onslow exercises his prerogative with merciless pen, and strikes out any provision referring to the matter. We should dearly like to know the reason for this high-handedness. Only the other week allusion was made in the editorial columns to the insertion in the North Metropolitan Electric Supply Company's Bill, by a Committee of the Commons, of a protecting clause for the Metropolitan Water Board. The Lord Chairman has now struck out the clause. He had not heard the evidence; the Commons Committee had.

Cost of Old-Age Pensions.

Some further material has been offered towards a solution of the vexed problem of what would be the cost of instituting in this country a system of old-age peusions such as is dear to the heart—or so it is claimed to be—of the up-to-date politician. Whatever may be the cost of any scheme that may be finally brought into force, it will have to be paid in some manner or another, and therefore the topic is one of general interest, not alone to those who look to benefit from its provisions. It has already been argued that the money required to finance any such proposal must be a gigantic sum; and the figures just issued by the Local Government Board in the shape of a Blue-Book do nothing towards altering this view. There is given a series of tables relating to the population, &c., and a memorandum giving a summary of the schemes considered by various Committees. The age generally agreed upon at which persons would become qualified to receive a pension is 65 years (the limits fixed by the statutes governing State pensions at the Antipodes); and the number of persons of this age and over in the United Kingdom at the present time is estimated at 2,116,000. To grant a pension of 5s. a week—an amount which can hardly be considered as sufficient to serve any real purpose—to all persons of this

age without distinction would therefore require £27,508,000; and some idea of what this means may be gathered from the fact that it would be equivalent to a tax of about 12s. 6d. per head on the total estimated population. Of course, the cost would be largely reduced if a limit of income for those eligible for pensions were fixed, as has often been suggested. If from the total already given were deducted those whose incomes exceed 10s. a week, and also paupers, aliens, and persons with other disqualifications, the number, it is calculated, would be reduced to 686,000, or 32·4 per cent., of the population over 65 years of age. But there are at any rate two possible objections to be urged against the provision of any discriminating scheme. In the first place, it would seem to some extent to place a premium on unthriftiness; and, in the second, it might have the appearance at all events of being only another form of charitable relief. In any event—even if no limit of income were fixed as entitling persons to a pension—there would, of course, be a large number of people who would not apply for their 5s. a week; and to this extent the estimated cost would be modified. This "Blue-Book" pronouncement, however, is sufficient to give an idea of what old-age pensions will mean, and to afford scope for reflection on the other side of the question—that relating to the finding of the money.

Workmen's Compensation Statistics.

As an outcome of the resolution passed by the Institution of Gas Engineers at Dublin (requesting the Council to appoint a Committee to consider the question of insurance under the Workmen's Compensation Acts), Mr. Hanbury Thomas, the General Manager of the Sheffield United Gaslight Company, forwards a letter, which we have much pleasure in publishing, giving the experience of his Company with regard to a scheme instituted at the time of the passing of the first Act. Under this, there was set aside a sum equal to 6s. 8d. per cent. on the total wages paid by the Company; and after 8½ years' working there was a sum in hand, after the settlement of all claims, of £709, out of the £2509 placed to the fund—the claims paid having amounted to £1798, equal to 4s. 9·29d. per cent. on the wages. Had, however, the provisions of the 1906 Act applied, the compensation would have amounted to £2286, or 6s. 0·84d. per cent. on the wages paid; and the balance remaining in hand would have only been £223. As this would not have been sufficient provision for any disastrous accident, the Board have decided, as from the 1st inst., to increase the sum set aside from 6s. 8d. to 8s. per cent. on the total wages paid, which it is thought will make matters about the same as they were with the lower percentage under the old Act. Mr. Hanbury Thomas points out that compensation for machinery accidents has only accounted for 5·43 per cent. of the total paid; and his statistics bear out the contention of Sir George Livesey that the larger proportion of accidents happen to the younger men—age bringing with it greater care and steadiness at work. A report by Mr. W. R. Herring, of Edinburgh, on the same subject is noticed in our news columns.

Mr. H. E. Jones on the Continental Gas Engineer.

Certain remarks made by Mr. H. E. Jones at the meeting of the European Gas Company may escape the observation of some professional readers if not given a little more prominence than they obtain in the rear part of the report of the proceedings at that meeting. The remarks were very flattering to the Engineers of the Company; but as they also involved comparison, they may be read with mixed feelings by professional gas engineers in this country, among whom, it must not be overlooked, is Mr. Jones. He was seconding a vote of thanks to the officers of the Company; and he said the staff of the Company was filled, in its most important places, by men of education and experience. Especially was this so of the engineering staff. Their men were trained in engineering, apart from gas engineering, before they came to the gas department; and they worked in a most conscientious manner. In fact, having to do with a few gas undertakings in this country, he often said he wished there was the same scrupulous care here over the small details, more particularly in the matter of residuals. The precision and care with which every small thing was turned to account was most remarkable, and to the different matters of extension from the engineering point of view, there was devoted not only competence, but great care and study.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 269.)

Business on the Stock Exchange last week was very quiet all through; and towards the end the attendance became so thin owing to the absentees being tempted away by delightful weather and out-door attractions, that there was scarcely any movement at all. The varying tendencies were not so pronounced as they had been in the week before; but still the tone was capricious and irregular. The opening afforded a fairly promising prospect. There was some buying, and one or two important markets improved. But the gilt-edged was not among the number. On Tuesday, things marched irregularly; Consols recovering fractionally, while Rails were poor. This line of action was exactly reversed the next day; while in other departments there were irregular ups and downs. On Thursday, the general prevailing tendency was dull; and the gilt-edged division was depressed by the influence of unwelcome new issues. Friday was a very quiet day, and things remained dull; the American Market being about the only one able to throw off depression. Saturday was almost a *dies non;* and markets remained steady and listless. In the Money Market, there was an abundant supply to meet all demands; and rates for short loans were very easy. Discount rates held on for a while, but gave way at last. Business in the Gas Market was, on the whole, quieter than the previous week; only two or three days furnishing a respectable quota. The general tendency was quite favourable; and movements in quotation, though few in number and slight in degree, were in the upward direction. In Gaslight and Coke issues, the ordinary was fairly active and very steady. The announcement by the Board of Directors that, after paying the same rate of dividend, they would carry forward a balance of undivided profits greater by £77,000 than they did six months ago, reached the market apparently too late to have any effect. The figures at which transactions were marked ranged from 96 to 97½. In the secured issues, the maximum was done at 89 and 90, the preference at from 105 to 107, and the debenture at from 82½ to 83½. South Metropolitan was quiet and firm; dealings being marked at from 120½ to 122 in the ordinary, and at 82¼ and 82¾ in the debenture stock—a rise of 1 in each issue. The only transaction in Commercial was one in the 4 per cent., at 107. The Suburban and Provincial group were quieter than usual. Alliance new was done at 13¾, British at 42, South Suburban at 118½, and Tottenham "B" at 101. Among the Continental Gas Companies, Imperial was 2 points higher, with transactions ranging from 172¼ to 174½. European fully-paid was ½ higher, at 23¼ and 23⅞; and Union was done at 113. Among the undertakings of the remoter world, Buenos Ayres changed hands at 11⅛, Primitiva at 6$\frac{15}{16}$, ditto preference at 5$\frac{1}{16}$ and 5$\frac{3}{16}$, River Plate at from 12$\frac{15}{16}$ to 13⅛, ditto debenture at 94½, San Paulo 13¼ (a rise of ¼), and Monte Video at 10¾.

ELECTRIC LIGHTING MEMORANDA.

Puffing the Osram Lamp in the Daily Press — Ill-Considered Cost Comparisons—Some Considerations for the Public—Reputed Long Life with a Weakly Constitution—Some Calculations from the "Electrical Review," and a Supplement.

The General Electric Company, who own in this country the patents for the Osram metallic filament lamp—one of Baron Welsbach's inventions—have, we fancy, been setting their tooter to work in the Daily Press; for last week pretty articles on all the nice points of the Osram type of lamp appeared in the "Daily Telegraph" and the "Standard," and, by sundry contortions, the latter paper jumped—it did not arrive at it by any complete and serious consideration of the subject—at the conclusion that the Osram lamp was the one thing that the electrical industry has been waiting for to make electric lighting cheaper than gas. Of course, that is news to the electrical industry, the workers in which are able, by their technical knowledge, to look behind the scenes with clearer perception than the journalists of the Daily Press, whose capacity for receiving, believing, and misleading on technical matters is one of the wonders of modern times. There are several things touching upon the question of the first and running costs of the Osram lamps of which the daily journalist knows nothing, and so he accepts, as his informative base for misguiding the public, that the efficiency of the Osram lamp is four times that of the carbon filament lamp. The "Daily Telegraph" says that—

> With one Osram lamp of 32-candle power and one carbon lamp of 16-candle power, there is a very great saving per 1000 hours in favour of the new invention. With electricity at 4d. per unit, the saving figures out at 4s. 8d.; at 6d. per unit, the saving is 8s. 6d.; and at 8d. per unit, it is 12s. 4d.

What will be said later will show that this naked statement does not deserve any credence. After stating that the new invention is going to exert a "considerable influence on the lives of the people," the "Standard" makes these remarks—

> To compare it [the Osram lamp], in the first instance, with gas. With an incandescent gas-burner consuming 4 cubic feet, and having a bye-pass consuming ¼ cubic foot per hour, the cost for lighting per annum per 1000 burning hours, and with the bye-pass constantly alight, with gas at 3s. per 1000 cubic feet, would be 18s. An "Osram"

lamp, *giving the same illuminating value*, will consume 35 watts, and will cost for the same burning hours 11s. 8d. with electric light at 4d. per unit, or 14s. 7d. if the price is 5d. per unit. Thus electric lighting, with all those conditions which make it so great a luxury, is now made available at a lower price than gas lighting.

Surely now, after such an oracular statement, we ought to take a back-seat, and keep silent, on the principle that the least said the soonest mended. But no such intention animates us just at the present time; for the credulity that allowed the publication in the "Standard" of the quoted passages is so prominent a feature of the statement that we cannot refrain from having a tilt at our contemporary.

A few words first as to the consumption of the incandescent gas-burner. It is put at 4 cubic feet per hour; and thus the consumption, assuming the burner to be used 1000 hours a year, amounts to 4000 cubic feet. But we fail to see why the incandescent gas-burner should be saddled with ¼ cubic foot per hour consumption for the remaining 7760 hours in a year for a bye-pass jet, when a penny or two spent in safety matches will do all the lighting necessary for the one burner in the 1000 hours. The calculation for the cost of gas is thus reduced to 12s., at 3s. per 1000 cubic feet, instead of 18s. Then electricians have given their authority for stating that 18 candles (the whole British standard candle, and not the Hefner candle, which only equals 0·88 of 1 of the British type) can be obtained per cubic foot of gas consumed with respectable ordinary incandescent burners; so that the consumption of 4 cubic feet per hour should give, under easily maintainable proper conditions, 72 candles. Now how can the writer of the "Standard" article reconcile with facts his statement that the Osram lamp makes electric lighting available at a lower price than gas lighting. An Osram lamp, he says, giving "the same illuminating power" as the incandescent gas-burner, will consume 35 watts per hour; and we see in a table given later in his article that a 35-watt Osram lamp has a nominal illuminating power of only 32 candles, and those are Hefner candles from which 12 per cent. must be knocked off to find the equivalent in British standard candles. On the authority of Mr. Lancelot Wild, of the Westminster Electrical Laboratory, the illuminating power of Osram lamps is from 26 to 29 candles (British standard); and the consumption of watts from 34 to 36, and from about 1·2 to nearly 1·4 watts per candle. Again, it is not—if it is, he does not say so—within the knowledge of the writer in the "Standard" that, with the pressures for the greater part in vogue in this country, two of the Osram lamps will have to be used in series; so that, while the cost for current and lamps will in the majority of places have to be multiplied by two, the illuminating power of the two lamps—say, 60 candles together—will not come up to that of the one 4 cubic feet per hour incandescent gas-burner. Upon this, there is the first and renewal cost of the Osram lamps; and this is much heavier than in the case of incandescent gas mantles. A 32 Hefner nominal candle power Osram lamp costs 4s.; a 50-candle power one, 4s. 3d.; and a 100-candle power one, 6s. 6d.

Long life is claimed for these Osram lamps; but there are a few considerations affecting this point. The diameter of the filament is only 0·04 mm., which is finer than the average human hair. And there is electrical authority for saying that for voltages from 125 to 130, the lamps must be used in a vertical pendant position, as the filament at the high temperature to which it is heated when running is quite soft, and would otherwise sag against its supports. On the other hand, the filament when cold is brittle, and should not be jarred. It is therefore considered advisable when the holders in which the lamps are fixed are subject to vibration, to arrange for a flexible wire support. What affectionate care will have to be taken of these lamps to ensure good and constant service! When all these matters are taken into consideration, we are not so confident as the "Daily Telegraph" that "when the householder becomes aware of the advantages of the new light, there will be a great demand for this method of illumination," nor as the "Standard," that the "invention must exert a considerable influence on the lives of the people," nor that the lamp "makes it economically possible for electric light to be carried into all the poorer houses and dwellings throughout the country," nor is the lamp going to make an enormous difference in the capital outlay for generating-stations. Wild and uninformed writing such as our daily contemporaries have been indulging in will not help the electric industry. The public will not be long learning the disadvantages as well as the advantages of the lamp. We grant freely the one advantage compared with the carbon filament lamp, of greater efficiency in respect of illuminating power and wattage; but are there not in what we have written points which materially discount that one gain? It is not a gain that stands unaffected.

Our better-informed friends of the "Electrical Review" see things through glasses different from those of the writers in the two daily papers. The optimism of the latter finds no echo in these lines from the "Review:"

> The difficulty in obtaining supplies of lamps of the tungsten group, coupled with the fact that their present working pressure appears to be limited to 100 or 110 volts, has so far put obstacles in the way of their general application. Few consumers at the present stage feel justified in incurring the expense of altering their installation in order to effect a first economy in use, which is to some extent discounted by the high price and greater candle power of the lamps supplied, and is ultimately an uncertain quantity, owing to the little information available with regard to life and durability under ordinary conditions of use.

Our contemporary, however, does see cases—as in shops where artificial light is used to a late hour—presenting opportunity for the use of "current-saving lamps," even at considerably greater first cost. Apology must be made to the "Review" for quoting so extensively from its article; but the importance attaching to the calculation which is the kernel of the article is such that we prefer not to paraphrase the statement—

With an alternating current supply, and the installations divided into equal groups of about 100 volts pressure by means of auto-transformers, an improvement of the following order may be anticipated: Taking ten 30-watt lamps of 32 nominal candle power, the maximum out-of-balance current will be about 1·5 amperes. An auto-coil to deal with this can be obtained for £3, having a consumption not exceeding 3½ watts. If this voltage reducing apparatus be erected and energized at the expense of the supply authority, the yearly cost will be—

£3 at (say) 10 per cent. for capital charges and depreciation	6s. 0d.
$\frac{3{\cdot}5 \text{ watts} \times 8760 \text{ hours}}{1000}$ = 30·66 units at (say) 1d.	2 7
	8s. 7d.

Say, 10s. per annum, which should be easily recoverable as a rental. The comparison in cost of the lighting between carbon and metal filaments per year of 1800 hours would be as follows:—

Metallic Filament.		Carbon Filament.	
Ten 32-c.p. 30-watt lamps = 320 *c.p.*		*Ten 16-c.p. 60-watt lamps* = 160 *c.p.*	
$\frac{10 \times 30 \times 1800}{1000}$ = 540		$\frac{10 \times 60 \times 1800}{1000}$ = 1080	
540 units at 4d.	£9 0	1080 units at 4d.	£18 0
Extra rental of an auto-coil.	0 10	Say, three renewals of lamps (average life 600 hours), 30 at 1s.	1 10
Say, three renewals of lamps (average life 600 hours), 30 at 4s.	6 0		
	£15 10		£19 10

Showing in favour of the metallic lamp an economy of over 20 per cent., with a nominal increase in light of 100 per cent.

We assume from the figures that the writer of the article has the Osram lamp in mind, as we know of no other metallic filament lamp claiming an efficiency approaching the one taken in the computation here—less than a watt per candle power! If we are right as to the Osram lamp being in view, then the calculator may be referred to the remarks on the candle power and to Mr. Wild's and the General Electric Company's figures as to the wattage for a 32 Hefner candle lamp. The candle power is about 4 candles too high by British measurement; and the watts 5 too low per lamp per hour. This will make a little difference in the totals of the first table. For the purpose of comparison, we will add another table to the two presented by our contemporary:

Ten 64-c.p. incandescent gas-lamps 3½ cubic feet per hour = 640 c.p.

$10 \times 3\frac{1}{2} \times 1800$ = 63,000 cubic feet.

63,000 cubic feet at 3s. per 1000 c. f.	£9 9 0
40 mantles at 4½d.	0 15 0
	£10 4 0

Thus doing an injustice to all towns that supply gas at below 3s., and taking the high average of four mantles per burner per annum, it is found, on the basis of the "Electrical Review" calculations, that twice the illuminating power can be obtained with ten incandescent gas-burners at a price £5 6s. lower than the best our contemporary can show for metallic filaments.

Reported Discovery of Coal in Sussex.—The Central News learns that, as a result of investigations undertaken at the instance of Earl De La Warr, an important discovery of coal has just been made upon his Lordship's Sussex estate, in the neighbourhood of Ashdown Forest. The seam, which runs north and south, is stated to be at some points within 20 feet of the surface. Experts had been experimenting in the district for some time, and had formed the opinion that the area would be found to be coal-bearing.

Prevention of Corruption Act, 1906.—Readers may remember that at the annual general meeting of the Society of British Gas Industries early in the year a paper dealing with the above-named Act was read by Mr. C. E. Brackenbury, Barrister-at-Law. In preparing the paper, the author confined himself mainly to the points of more especial interest to his audience. He has, however, since recast and added to it, so as to render his exposition of the Act of general use. In its extended form it has been reprinted as a pamphlet, published by Messrs. Stevens and Sons, No. 120, Chancery Lane, price 1s. net.

The Late Sir William Perkin.—The funeral of Sir William Henry Perkin, F.R.S., whose death, on the 14th inst., was recorded in the "Journal" last Tuesday, took place the next afternoon at Christ Church, Roxeth, Harrow, amid signs of general mourning. Among those present were Professor W. Odling, F.R.S., representing the University of Oxford; Professor R. Meldola, F.R.S., representing the Royal Society and the Chemical Society; Professor Percy F. Frankland, F.R.S., and Dr. E. Divers, F.R.S., representing the Institute of Chemistry; Sir R. Pullar, M.P., Sir Boverton Redwood, with Mr. C. Creswell and Mr. S. Hall, representing the Society of Chemical Industry; Professor W. A. Tilden, F.R.S., and Sir W. Ramsay representing the Chemical Society; Dr. L. T. Thorne, Professor H. E. Armstrong, F.R.S., Professor Clowes, and Professor Emerson Reynolds, F.R.S.

THE INTERNATIONAL PHOTOMETRIC COMMITTEE.

Second Session at Zurich.

(From our Special Correspondent.)

It is rather more than four years since the International Photometric Committee, which was nominated originally by the International Gas Congress at Paris in 1900, held its first session in Zürich on the eve of the general meeting of 1903 of the German Association of Gas and Water Engineers in that attractive town. The second session, which, according to the arrangements made then, should have been held in 1905, has been deferred from time to time, and was ultimately fixed for the final three days of last week, when it was a real pleasure to see gathered together again in the industrial capital of Switzerland the majority of the members of the Committee who attended the session four years ago. There were notable and much regretted absentees. Death, alas! had removed one of the members—Herr H. Nachtsheim, of Vienna. Professor Vivian B. Lewes and Mr. Charles Carpenter, of London, Dr. H. Bunte, Professor at the Technical College at Carlsruhe, and Heer J. van Rossum du Chattel, of the Amsterdam gas undertaking, were all prevented by other claims on their time from attending the present conference. The absence of the last named was especially lamented, because it was known to be due indirectly to the recent death of Heer van der Horst.

Notwithstanding the enforced abstentions, there was a notable assembly of photometricians from all parts of the Continent when the session opened on Thursday at 10.30 a.m. at the Grand Hôtel Bellevue au Lac. The members present were: Signor M. Böhm, Engineer of the Milan Gas-Works, and delegate of the Italian Gas Engineers' Society; Professor E. Brodhun, of the Imperial Physical Technical Institute, Charlottenburg; Dr. H. Drehschmidt, Chemist to the Berlin municipal gas undertaking; Mr. J. W. Helps, Chief Engineer of the Croydon Gas Company, and delegate of the Institution of Gas Engineers; Dr. H. Krüss, of Hamburg; M. Laporte, Assistant-Manager of the Central Electricity Laboratory at Paris; M. Lauriol, Chief Engineer of Public Lighting at Paris; Herr J. Nolte, General Manager of the New Gas Company of Berlin, and President of the German Association of Gas and Water Engineers; M. Sainte-Claire Deville, Chief Engineer of the Experimental Works of the Paris Gas Company; Dr. H. Strache, Professor at the Technical College at Vienna, and delegate of the Austro-Hungarian Association of Gas Engineers; Dr. L. J. Terneden, Chemist of the Amsterdam Gas-Works, and delegate of the Dutch Association of Gas Managers; Herr A. Weiss, Manager of the Zürich gas undertaking, and delegate of the Swiss Gas Engineers Association; and M. Th. Vautier, Professor at the University at Lyons, who presided, as in 1903, at the conferences held. Mr. C. C. Paterson attended as a delegate from the National Physical Laboratory at Teddington; and the indefatigable and genial Editor of the "Journal des Usines à Gaz," M. Ph. Delahaye, again acted as Secretary to the Committee. It will be seen, therefore, that, as no fewer than seven countries were represented at the session of the Committee, the proceedings may be rightly regarded as being truly international in character.

Welcome to Zurich.

The Municipality of Zürich extended a warm welcome to the delegates, and on Friday evening entertained them lavishly at a banquet at the Grand Hôtel Bellevue, at which Herr Fritschi, one of the City Councillors, presided on behalf of the Burgomaster. The town of Zürich was throughout in gala dress, owing to the concluding matches of the Federal Rifle Meeting being in progress when the session of the Photometric Committee opened.

Opening of the Business.

The proceedings formally commenced on Thursday morning at 10.30, when the delegates assembled in a room at the Grand Hôtel Bellevue. M. Vautier, on taking the presidential chair, expressed the regret of the members at the absence of Dr. Bunte, Professor Vivian B. Lewes, Mr. Charles Carpenter, and Heer van Rossum du Chattel. On his proposal, Herr Nolte and Mr. Helps were elected Vice-Presidents of the Committee. He then referred to the changes which had taken place since the last meeting in the constitution of the Committee—viz., the substitution of Professor H. Strache for Herr Nachtsheim (deceased) as representative of Austria-Hungary, and of Herr Nolte for Herr W. von Oechelhaeuser as one of the representatives of Germany. Next he announced that the authorities of the Federal Polytechnic at Zürich had, at the instance of Professor Lunge, who, unfortunately, was prevented by illness from welcoming them, placed at the disposal of the Committee for their subsequent meetings one of the lecture theatres in the Chemical Laboratories. Also, Professors Coustam, Grandmougin, Treadwell, A. Weber, and Weiss, of the Polytechnic staff, had kindly promised to act, together with a number of their assistants, as interpreters at the meetings.

Photometry of Lights of Different Colours.

The first communication taken was a paper by M. Lauriol, of Paris, on the "Photometry of Lights of Different Colours." A translation of this paper is given on another page [243] of to-day's "Journal." The proposals of the author were discussed by Herr Brodhun, Herr Krüss, M. Laporte, M. Sainte-Claire Deville, Mr. Paterson, and Herr Strache. The general trend of the remarks was to the effect that the suggested wedge type of photometer depended for its accuracy on the exact setting of the wedge, which was a matter of great difficulty. Mr. Paterson found no difficulty in comparing electric filament lamps, giving lights of different tints, with one another; and the ratios which he found to subsist between them had been confirmed by Professor Brodhun at the Reichsanstalt. This was the case, notwithstanding that the distance of the sources from the screen varied in the two places; the illumination at the National Physical Laboratory being one candle-metre, and at the Reichsanstalt ¼ candle-metre. M. Lauriol having observed that his experiments covered a range of sources of light of very widely differing colours, the President summed up the points raised in the paper, and recommended the members of the Committee to institute further experiments in the directions suggested by M. Lauriol, as they would doubtless be of great service in photometry in general. The morning's session then closed.

Reports of the German, French, and English Laboratories.

On Thursday afternoon, the Committee re-assembled at the Chemical Laboratory of the Polytechnic, and received the reports of the German, French, and English Laboratories on their investigations on the ratios subsisting between the Carcel, Hefner, and Harcourt standards of light. Professor Brodhun first read the more essential parts of a paper by Dr. E. Liebenthal, of the Reichsanstalt, on the comparisons made at that laboratory of the three standards. This paper was a reproduction of the one by the same author as presented at the meeting of the German Association of Gas and Water Engineers at Bremen last year, and of which a translation has already been given in the pages of the "Journal."*

In reply to a question by the President on the point raised by Dr. Liebenthal, as to the variation of the light of the Harcourt 10-candle standard with variations in the setting of the height of the flame, Mr. Paterson said that, in his experience, the light was constant when the height of the flame was not more than 1 mm. above or below the normal position; but that when the height of the flame was 2 mm. above or below the normal, a variation of 0·2 to 0·3 per cent. in the light was introduced.

Mr. Paterson then presented the report of the National Physical Laboratory on the comparisons made there at the instance of the Institution of Gas Engineers. This report was substantially a translation (in French) of that made by the Laboratory to the Institution in May, 1905, which has been regarded by the Institution as confidential pending this meeting of the members of the International Committee. Though a considerable part of the results of the work covered by the report has been divulged by Mr. Paterson in the paper which he read in January last before the Institution of Electrical Engineers, we take the opportunity of reproducing, on another page of to-day's "Journal" [232], the actual report made by the Laboratory to the Institution of Gas Engineers. Mr. Paterson stated that, since the report was prepared, his further experience with more Harcourt lamps had indicated that new lamps had a somewhat lower candle-power. The lamps seemed to increase somewhat in illuminating power by use up to a certain point. The increase amounted to from 0·5 to 0·75 per cent. He had not been able wholly to account for this change; but it seemed partly associated with the inner chimney of the lamp. On changing a new chimney for an old one, there was an appreciable increase in the light afforded. He mentioned the fact because the lamps used at the German and French laboratories were probably not so old as the one used at the English laboratory, and therefore might have a slightly lower illuminating value. He was sure there was such a difference as he had mentioned, though he was not so sure of the cause. Mr. J. W. Helps said that he understood that no such differences had been observed in the laboratory of the Gas Referees in the many lamps examined there.

The report on the investigations made at the French Laboratories by M. Perot and M. Janet was then presented and discussed. This report has also been previously dealt with in the "Journal." A supplementary report on further investigations was also presented by M. Laporte, who afterwards read a summary which he had prepared of the results obtained in the comparison of the three standards at or by (1) the Reichsanstalt, (2) the National Physical Laboratory, (3) the Laboratoire d'Essais du Conservatoire National des Arts et Métiers and the Laboratoire Central d'Electricité de Paris, (4) Mr. Sharpe, in 1903, (5) Mr. Hyde, in 1906, and (6) MM. Laporte and Jonaust, in 1907. After considerable discussion, a Sub-Committee, consisting of Professor Brodhun, M. Laporte, and Mr. Paterson, was appointed to prepare a recommendation as to the ratios which

* See "Journal," Vol. XCV., p. 102.

the Committee should assign as subsisting between the values of the three standards, and submit it for adoption at a subsequent session of the Committee. This closed the day's proceedings.

Photometry of Incandescent Burners.

The Committee met again on Friday morning at the Polytechnic; and the first matter was the reading by the President of a communication which Heer van Rossum du Chattel had forwarded, dealing with the methods adopted in Holland for measuring the light of incandescent gas-burners. An abstract translation of this communication is given on another page to-day [235]. The communication led to a discursive discussion on the photometry of incandescent burners, especially in relation to spherical and hemispherical illuminating power and the methods for determining either. Further particulars of this discussion will be given in the continuation of this report next week.

Mr. Helps then made a report on the methods of measuring the light of incandescent burners in use in England. He said that he had applied to about 250 engineers of gas-works for information on the point; but the replies received indicated that there was very little systematic testing of incandescent burners carried on in English gas-works. As to the form of photometer, the ordinary enclosed Letheby seemed most general; but, specially for mantle testing, the Flicker photometer, adapted for measuring either horizontal or angular illuminating power, was also used. Only very few engineers were using the photometer devised by himself and Mr. Carpenter which was exhibited at the last meeting of the International Committee. He believed this was not due to any defect of that photometer, but to the fact that no attempt had been made to push its sale. Horizontal readings only were commonly made in English gas-works; and for upturned incandescent burners, they appeared to suffice. But angular readings were very important in the case of inverted burners, as figures which one gas engineer had communicated to him indicated. They referred to five types of inverted burner. Generally speaking, there was a falling off from the horizontal illuminating power at an angle of 10° to 12° below the horizontal, and then a continuous rise up to 90° (or vertically downwards). For the five burners, the values for the horizontal and the vertically downwards measurements were as follows:—

Duty Obtained, Candles per Cubic Foot.	Burner No. I.	Burner No. II.	Burner No. III.	Burner No. IV.	Burner No. V.
Horizontal	16·75	13	13·9	12·3	14·9
Vertically below	28·7	25	25·7	25·2	31·8

These figures, he thought, proved the necessity for angular readings. A question which was now being seriously discussed by English gas engineers was whether the time had not arrived for a standardization of sizes of incandescent burners and mantles, in order to effect economy in maintenance by only a few sizes of mantles being requisite. There should be no great difficulty in standardizing the sizes of upturned burners; but the inverted burner had not yet advanced to such a stage that standardization could be arranged. Mr. Helps took the opportunity of apologizing on behalf of Mr. Carpenter for his enforced absence from the meeting.

After some further discussion on the question of spherical or hemispherical determinations for expressing the value of sources of light, the meeting was adjourned to the afternoon.

When the Committee re-assembled, there was some discussion on the practicability of a molten platinum unit as a primary reference standard of light. Then the subject of discussion was that of a standard incandescent burner for mantle testing, and the shape of mantles.

Illuminating Power in Self-Luminous and Incandescent Burners.

On Saturday morning, M. Sainte-Claire Deville presented a voluminous communication on researches which he had conducted on the illuminating power in self-luminous and incandescent burners of coal gas, water gas, and mixtures of the two gases. This was in continuation of the work which he described at the last meeting of the International Committee, of which a detailed report was given in the "Journal" at the time (Vol. LXXXIII., pp. 499, 567, 617). The subject was discussed, mainly by Dr. H. Strache and M. Vautier.

Ratios of Standards of Light.

Then the report of the Sub-Committee on the ratios subsisting between the intensities of the three standards of light was presented and adopted by the meeting. It was decided that the relative values should be taken as follows:—

Carcel . . = $10{\cdot}75$ Hefners
Harcourt . = $10{\cdot}95$,,
,, . = $1{\cdot}02_0$,,
} Probable error ± 1 per cent.

The small figures written beneath the line could not be regarded as significant. The ratios were stated in this manner, because the figure was thus always greater than unity. The standards were taken to be burning under the normal conditions of atmospheric humidity for each—viz., for the Carcel and the Harcourt standards, 10 litres of aqueous vapour to 1000 litres of dry air; and for the Hefner standard, 8·8 litres to 1000.

The views of some of the individual members of the Sub-Committee were given by way of putting on record that they were not in entire agreement as to the form of the statement adopted.

New Testing Burner for London Gas.

On Saturday afternoon, Mr. Helps read a paper on the "New Standard Burner for Testing the Illuminating Power of London Gas," written by himself and Mr. Carpenter; and he showed the "Metropolitan" argand burner No. 2 in use, and explained its operation. The paper is reproduced on another page [235] of this issue. Discussion ensued on this and M. Sainte-Claire Deville's paper, already referred to; and Mr. Helps stated that no consideration would now induce English gas engineers to go back to the plan of burning the gas at such a rate as would afford a flame of fixed intensity, nor to give up the new standard burner.

The Committee's Resolutions.

The Committee then proceeded to settle certain resolutions based on the matters discussed at the meeting; and ultimately the following were moved and passed unanimously:—

I.—The International Committee on Photometry, having taken into consideration the adaptability of the electric furnace to the fusion and distillation of the refractory metals, as demonstrated by Moissan, express the wish that researches should be pursued in the interest of photometry on the fusing point of platinum. The Committee instruct their Secretary to communicate with the National Laboratories of the countries concerned with the object of elucidating this problem.

II.—The Committee thank M. Sainte-Claire Deville for his important communication in continuation of his former work, and express their desire that experimental researches on the maximum illuminating power of the gas to the calorific power should be continued in the different countries.

III.—The Committee decide, on the suggestion of Professor Drehschmidt, to adopt the following symbols for illuminating power determined in the manner indicated:—

I_h = Horizontal illuminating power.
I_{α_s} = Illuminating power at an angle α to the horizontal above the horizontal.
I_{α_i} = Illuminating power at an angle α to the horizontal below the horizontal.
I_o = Mean spherical illuminating power.
$I_{\overline{o}}$ = ,, upper hemispherical illuminating power.
$I_{\underline{o}}$ = ,, lower ,, ,, ,, ,,
$I_{m\,\alpha\,s}$ / $I_{m\,\alpha\,i}$ = Maximum illuminating power in the upper (s) or lower (i) hemisphere, that maximum occurring at the angle α.

IV.—The International Commission on Photometry particularly direct the attention of the Photometric Committees of the various countries to the utility of determining the illuminating power of ordinary self-luminous flame burners and incandescent burners, both upturned and inverted, and to the establishment for the latter of the most satisfactory method of determining the mean hemispherical and spherical intensity, and ask those Committees to communicate the results to them.

Next Meeting.

The President read a letter from Dr. Love, of New York (who is a member of the Committee), expressing his sincere regret that he had been unable to take part in the proceedings, owing to the fact that he was busy establishing new testing-places in that city, and expressing his best wishes for a successful issue from the labours of the Committee.

It was decided, on the motion of Herr Weiss, that the Committee should hold their next meeting in about three years' time at Zurich, about the date July 20. Herr Weiss proposed a vote of thanks to M. Vautier for his services in the presidential chair; and it was passed with acclamation.

The late Mr. R. W. B. Creeke, the Managing-Director of Messrs. Henry Balfour and Co., Limited, of Leven, Fife, whose death was recorded in the "Journal" for April 9, left £3641.

Mr. John Devonshire Ellis, late Chairman and formerly Joint Managing Director of Messrs. John Brown and Co., Limited, of Sheffield, whose death last November was at the time recorded in the "Journal," left estate of the gross value of £56,725.

At the meeting of the Metropolitan Water Board on Friday, the Water Examination Committee reported that an application had been received by them from the Egyptian Government stating that it had been decided to appoint an International Conference of English, French, and German delegates to meet in Cairo to consider the water supply of Egypt. They had approached the Royal Society to nominate an English delegate; and the Society had recommended that Dr. Houston, the Board's Director of Water Examinations, should be appointed. The conference would last fifteen days, and Dr. Houston would be paid £750 for his services. The Committee recommended that he be permitted to go. A long discussion followed, on the advisability of allowing officers of the Board to accept such invitations. It was pointed out that Dr. Houston had recently been to Belfast, and received a fee of £370 for his visit; and now it was proposed to let him go to Egypt at a time of the year when his services were most required in the Metropolis. Eventually, however, the recommendation was agreed to.

THE LIGHTING OF SMALL TOWNS.*

Gas v. Electricity Works.

The small *brochure* which Herr Würdemann has prepared on the comparative results, financially, of the supply of light in quite small towns from either a gas-works or an electricity works, is full of statistics of a most instructive kind. His avowed object is to assist municipal or parochial authorities in making a proper choice of lighting plant for the public and private service. He points out that while there may nominally be many kinds of illuminating gas—for instance, water gas, air gas, and acetylene—practically the authorities need only consider coal gas, because the other gases named are less suitable for heating, cooking, and the development of power as well as for lighting. Hence the question is narrowed down to one of coal-gas-works or electricity works. Neither of them is purely a light-supply station, because with both a large part of the output will be for other than lighting purposes.

Having restricted the issue to coal gas or electricity, Herr Würdemann goes on to say that it is the duty of the local authority to erect the lighting works which will be of service to the largest number of the ratepayers. If gas-works and electricity works should be equally serviceable, then the one to be chosen must be that which should afford the best financial result, and so lay the smallest expenditure on both individual ratepayers and the community. In deciding this question, it is clearly necessary to know what has already been accomplished elsewhere by the two classes of works.

The *brochure* before us gives this information in a convenient form for a number of small towns in Germany. The plan followed has been to take two towns of nearly the same size and in the same neighbourhood, one of which has a gas-works and the other an electricity works. Then, side by side are placed the statistics (derived from the burgomaster or the works' manager) for the two cases—viz., the numbers of inhabitants, of households, of street-lamps, of consumers for lighting purposes, and of consumers for other purposes, the amount of current or gas sold and the prices, the capital expenditure, and (last but not least) the profit or loss. The average light obtained in each case is also reckoned out, on the basis of 350 Hefners (say, 320 candles) per B. of T. unit, or 80 Hefners (say, 73 candles) per 100 litres (= 3·53 cubic feet). This duty for gas is equivalent to 20½ candles per cubic foot. Other useful data are also included in the comparative tabular statements, which refer to sixteen pairs of towns—one of the pair having gas-works and the other electricity works.

We take the liberty of quoting some of the figures for one pair of towns in Hanover—Bentheim—which, with 4300 inhabitants, runs an electricity works, and Ahaus, which has 4500 inhabitants and owns a gas-works. There are 865 and 900 households in the respective towns, and for public lighting 119 glow lamps in the one and 110 gas-lamps in the other. But the glow lamps, alight for 2000 hours per annum, cost 7000 marks, and afford a total light of 6 million Hefners; while the gas-lamps burn 1600 hours at a cost of 2250 marks, and afford 13½ million Hefners. In all, 18·8 per cent. of the households take electricity for lighting purposes in Bentheim, and 25 per cent. take gas for the same purposes in Ahaus, while 8 per cent. also take it for cooking, for which electricity naturally fails to attract a single consumer. But Bentheim has 10 electro-motors of 32-horse power, and Ahaus only 3 gas-engines of 5-horse power. Current is charged at 7·2d. per B. of T. unit for lighting, and at 2·4d. for power (at Bentheim); gas at a little over 4s. 6d. per 1000 cubic feet for lighting, and a little under 3s. 5d. for power (at Ahaus). At these rates, 20,000 marks are paid for current for lighting, and 12 million Hefners obtained; 15,100 marks are paid for gas, and 76½ million Hefners are obtained; while the price paid per horse-power per hour by power customers is 2·16d. for current, and 0·84d. for gas. The capital expenditure on the Bentheim electricity works was 286,400 marks, and the working shows a loss of about 22,000 marks (= about £1100); while the gas-works at Ahaus have cost 175,000 marks, and have returned a profit of about 4500 marks (= about £225).

We have not picked out a pair of towns in which the comparison is exceptionally in favour of gas. These are some of Herr Würdemann's general conclusions: For lighting purposes, only about 17·7 per cent. of households take electricity; while 44 per cent. take gas. The electricity consumers pay 152 marks on the average apiece, and the gas consumers only 59 marks; while the latter obtain the more light. In the sixteen electricity-supplied places, the power supply amounts to 312,350 horse-power hours; in the gas-supplied towns to 437,500 horse-power hours; while, further, gas goes to 25·2 per cent. of the households for cooking or heating purposes. For public lighting, electricity is universally dearer and gives less illumination. Notwithstanding that the gas-works meet a greater demand, the capital outlay (on the basis of any unit whatever) comes out lower. As regards profit or loss, the showing is indeed remarkable. The electricity works are not generally able to cover interest and depreciation charges, and in many cases are a considerable drain on the town chest; while gas-works in every case meet their interest and depreciation charges, and often show quite considerable profits.

These facts speak for themselves. We recommend the advisers of smaller municipalities, and consulting and constructing electrical and gas engineers generally, to study Herr Würdemann's careful compilation, which we understand was undertaken by him at the instance of the engineering firm of Carl Francke, of Bremen.

* "Die Beleuchtung Kleiner Städte, auf Grund Statistischer Unterlagen." Bearbeitet von Ingenieur W. Würdemann. Bremen: B. H. Reiners; 1907.

NOTES FROM WESTMINSTER.

The process of clearing up is now going forward at Westminster; and it is safe to say there are few who will feel sorry when the present session has run its course. It has been most unsatisfactory in regard to public measures; and in connection with Private Bills, there has been very little animation. There are only a couple of notes to be presented this week; and both are on water topics.

A Long-Contested Water Scheme Won. The Great Yarmouth Water Company and the Lowestoft Water and Gas Company have won their joint Bill, incorporating a scheme for taking water from the River Bure; and the Great Yarmouth Corporation, who opposed, cannot complain that they did not have a fair and impartial hearing in both Houses. There has not been a scheme this session that has been gone into more thoroughly; and both the Lords and Commons Committees showed every consideration to promotors and opponents alike. But both pronounced in favour of the scheme, though both, too, increased the stringency of the conditions under which the powers to the Companies are granted. A feature of the case was that the Companies, in their own interests and in those of the public (which interests are identical), showed a perfect willingness to shoulder, before being compelled by the Committees, all obligations and duties essential to the protection from pollution of the proposed source of supply. The Companies want additional water; and the Great Yarmouth Corporation did not assail the necessity. It was only the source that they questioned. The Companies brought up engineering and chemical evidence to show the Committees that there was nothing threatening the purity of the Bure that could not be brought under subjection, given parliamentary power, by the means at command. The Companies secure their new source of supply at a heavy price; but it is the best and most available source offering for realizing an adequate supply. The Commons Committee have ordered that the subsidence reservoir to be constructed shall be of not less than nine days' capacity instead of seven; but a more serious condition—serious, but still accepted—is that such effective means are to be taken as are necessary to prevent any sewage or other offensive or injurious matter, solid or fluid, from passing into the river, between and including Coltishall and the point of the intake, down or through any sewer, drain, pipe, or channel. While this imposes a heavy responsibility on the Companies, it is locally feared that such plenary powers in the hands of the Companies for dealing with contamination will gravely affect the yachting industry and the wherry business on the Bure. The Companies may, however, be relied upon to exercise their powers with discrimination, in the interests of the public, from all points of view. The Bure itself as a pleasure resort will be none the worse for being maintained in a good sanitary condition.

Renfrewshire Upper District Water A note has already appeared on the Bill of the Renfrew County Council which proposes to constitute a new and large water-supply area, embracing the district served by the Busby Water Company. Reservoirs are projected at Bennan Loch and Loch Craig, at an estimated cost of £46,000. The Busby Water Company's undertaking is to be taken over by the County Council. Sittings over seven days were devoted to the consideration of the measure by Major Seeley's Committee—the Glasgow Corporation being in opposition. The Corporation had suffered a fall before the Earl of Camperdown's Committee with a scheme of their own; and they did not want the Renfrew County Council to get these water powers, as it was conjectured that it would spoil a project of annexation that the Corporation have in hand. Glasgow, when before the Committee, did everything possible to prevent what they appeared to think would be a catastrophe for their scheme. But Glasgow only began to attach importance to the water scheme when annexation was mooted. Among the points vigorously discussed was as to whether Glasgow could supply the higher ground in the district; but it was shown that the Corporation were willing to buy the Busby water-works. They offered to supply at a tenpenny rate; and evidence was forthcoming that the Corporation could not better the County Council in this respect, and the ultimate benefits of Glasgow's project were viewed with doubt. In the end, the County Council went off with their scheme; and the representatives of Glasgow to get cured of their chagrin as quickly as possible. Their disappointment was noticeably keen.

The Centenary of Gas Lighting.—In consequence of the pressure on our columns to-day, owing to the report of the proceedings at the Photometrical Congress, and other matters requiring immediate notice, we are compelled to hold over the next instalment of the article on "The Centenary of Gas Lighting."

PERSONAL.

Mr. Wm. M'Giffin, Manager of the Huntly (N.B.) Gas Company, has been appointed Manager of the Wick Gas Company.

Last Saturday week was degree day at Liverpool University; and among the honorary degrees conferred was that of LL.D. upon Pro-Chancellor Sir Edward Lawrence, who for twenty-three years was Chairman of the Liverpool United Gas Company—a position he relinquished about three years ago.

The "Co-Partnership Journal" of the South Metropolitan Gas Company records the following resolution, which was unanimously agreed to at a special meeting of the Co-Partnership Committee last month: "That the Committee desire to express their deepest sympathy with Mr. Frank Bush in his long illness, and to express their hope that he may be soon restored to vigorous health and strength."

The position of Gas Manager to the Leek Urban District Council, which was rendered vacant by the removal of Mr. A. A. T. Botteley to Wolstanton, has been filled by the appointment of Mr. Sidney T. Smith, who is at present engaged at the Walsall Gas-Works. The salary is £180 per annum, with house, coal and gas, &c. Mr. Smith is one of the Vice-Presidents of the Midland Junior Gas Engineering Association.

Mr. George E. Ashurst, the Chief Clerk of the Wallasey Gas and Water Department, was successful at the recent associate's examination in connection with the Chartered Institute of Secretaries, held under the auspices of the Victoria University, Manchester. Mr. Ashurst at present holds a first-class certificate in "Gas Manufacture," and is also the possessor of a number of certificates for advanced book-keeping and accountancy, &c.

In the course of his speech at the meeting of the European Gas Company, Limited, last Tuesday, the Chairman (Mr. R. Hesketh Jones) referred to various changes which have had to be made in the Company's technical staff, consequent on the retirement of M. Marchal, the esteemed Manager at Nantes. We learn that M. Gustave Gautier has been removed from Rouen to take on the more responsible duties at Nantes. M. Huon (whom several of the members of the Institution of Gas Engineers had the pleasure of meeting last year) goes from Boulogne to Rouen. M. Cros proceeds from Amiens to Boulogne; and M. Bertin, Assistant at Rouen, has been elevated to the managerial post at Amiens. Satisfaction was expressed that the Company's own staff included officers technically qualified to assume higher responsibilities than those that had previously fallen upon them.

The resignation of Mr. William Angus (who, as already recorded in the "Journal," has gone out to Buenos Ayres) of the position of Works Superintendent at the Windsor Street Station of the Birmingham Corporation Gas Department, has brought about the following changes in the staff: Mr. E. B. Tomlinson, from the Adderley Street Works, has been appointed Assistant Works Engineer and Superintendent at Windsor Street, Mr. J. H. Darrah, Junior Engineer at Windsor Street, being transferred to Adderley Street as Acting Superintendent for the present. Mr. C. H. Edmonds, from the Laboratory Staff at the Saltley Works, has been given the post of Junior Engineer at Windsor Street.

Presentations of illuminated addresses and framed photographs of the employees at the Dewsbury Gas-Works were recently made to Mr. Charles A. Craven, who, on account of ill-health, some time ago resigned his position as Manager, and to Mr. George Bradley, who has retired after 32 years' service—for most of the period as yard foreman. Mr. G. W. Fligg, the new Manager, who presided, remarked that they all felt very much parting with two officials who had been with them for such a number of years. That they were thoroughly appreciated and very highly esteemed, was shown by the way in which everyone in all departments of the undertaking had subscribed. Mr. Bradley was with them that day in very good health; and they hoped he would live many years to enjoy his well-earned retirement. As to Mr. Craven, they were acquainted with his circumstances; and he (Mr. Fligg) would take the presents to Mr. Craven on their behalf. Mr. Bradley, in acknowledgment, said he hoped the men would continue to be as faithful to his successor and to Mr. Fligg as they had been to him personally and to Mr. Craven. If they stuck together as they had done in the past, he did not think there was another gas-works in England which could be more successful.

A very appropriate souvenir in the shape of large mounted photographs of the party has been prepared, by the kindness of Messrs. George K. Harrison, Limited, for those members of the Midland Junior Gas Engineering Association who were fortunate enough to be present last month at the visit to the firm's works and mines. Particular interest will attach to one of these photographs, from the fact that it was taken in the fire-clay mine by means of a flashlight; but both the underground and above-ground pictures will form a very welcome memento of what was, in the opinion of all who took part in it, a most enjoyable and instructive outing.

COMPARATIVE COST OF GAS AND ELECTRICITY.

[Communicated.]

It may perhaps be considered by "Journal" readers rather late now, with the temperature at summer heat, to direct their attention to a pocket-book and diary for the present year; but the one published by Messrs. Rentell and Co., of Maiden Lane, W.C., under the title of "The Practical Electrician's Pocket-Book and Diary for 1907," which is edited by Mr. H. T. Crewe, M.I.Mech.E., contains some comparisons of the cost of gas and electricity which show so much bias in favour of the latter as to make them ludicrous in the eyes of any experienced person. This observation may seem rather strong; but I think it will be borne out by what follows. In the series of tables giving the costs referred to, No. 1 shows the equivalent price of gas per 1000 cubic feet comparing an incandescent electric lamp and an ordinary (flat-flame) gas-burner; No. 2 shows the comparison with an incandescent gas-burner; and No. 3 gives the equivalent price comparing a Tantalum electric lamp with (1) an ordinary and (2) an incandescent gas-burner. The tables purport to show the equivalent price of gas compared with electricity at various prices, ranging from 1d. to 6d. per unit; but the equivalent price of gas compared with electricity at 3d. per unit has alone been reproduced below—this being the lowest charged as a flat-rate by any corporation or company in the London district.

	3 Watts per C.P.	3½ Watts per C.P.	4 Watts per C.P.
Table No. 1 . . .	2s. 5d. ..	2s. 7d. ..	2s. 9d.
Table No. 2 . . .	2 9 ..	3 3 ..	3 9

	(1) 1 Watt per C.P.	(1) 2 Watts per C.P.	(2) 1 Watt per C.P.	(2) 2 Watts per C.P.
Table No. 3.	1s. 0d. ..	1s. 6d. ..	1s. 4½d. ..	2s. 4½d.

Below the tables appears the following: "All the above tables take into account all renewals, gas and electric, and price of same as obtained in practice by the author."

It is difficult to understand how the figures are arrived at. No fault can be found with Table No. 1; but, as anybody with any pretensions to being economical and up-to-date would consider the use of "ordinary" (as they are called in this publication) or flat-flame (as they are properly named) burners an unwarrantable piece of extravagance, this table may be passed over as unworthy of notice.

In Table No. 2, it will be seen that, taking the efficiency of an incandescent electric lamp at 3½ watts per candle power, electricity at 3d. per unit is stated to be equivalent to gas, when consumed in an incandescent burner, at 3s. 3d. per 1000 cubic feet. Let us consider what justification there is for this comparison. Assuming that an incandescent burner consuming 4 cubic feet per hour gives a light of 60-candle power, or 15 candle-hours per cubic foot, the following will be a truer comparison:—

286 candle-hours costs 3d. with electricity at 3d. per unit, calculating on an efficiency of 3½ watts per candle-hour.

286 ,, ,, 0·74d. with gas at 3s. 3d. per 1000 cubic feet, calculating on an efficiency of 15 candles per cubic foot.

In other words—

1d. with electricity will give 96 candle-hours.
1d. ,, gas ,, ,, 384 ,,

Showing that gas at the high price of 3s. 3d. per 1000 cubic feet (2s. 6d. is the average price in London) is four times cheaper than electricity at the low price of 3d. per unit (3d. is the lowest flat-rate price in London).

The supporter of the "Electrician's Pocket-Book" will exclaim that when the question of renewals is taken into consideration the result is very different. According to Mr. Lancelot Wild, a 16-candle power electric lamp should be renewed after a lifetime of 500 hours. This means an expense of 10d. every 500 hours. Taking 250 hours as the minimum lifetime of an incandescent mantle, it will be seen that two mantles, costing (say) 3½d. each, or 7d. in all, will outlast an electric lamp. This allows 3d. per 500 hours to pay for chimneys, forks, and depreciation of burners. Some may say that 3½d. is not sufficient to buy a good mantle, and that 250 hours' consumption is too long to take as an average lifetime; but the writer's experience is with mantles retailed at 3½d. each, which are found to last, on an average, rather more than six months—a lifetime which would, on a moderate computation, allow a margin considerably in excess of 250 hours' consumption. It will thus be seen that, so far as renewals are concerned, no great difference is discernible in the relative use of gas and electricity. The writer has a lurking suspicion that these erroneous comparisons are based on the supposition that an incandescent gas-burner gives a light of only 16-candle power; otherwise the results are incomprehensible.

In another part of the publication under notice the author makes the following statement: "Improved burners and incandescent mantles have been devised to lessen the difference and improve the position on the part of gas; but the increased cost of such burners and the constant renewals of mantles necessary on account of their extreme fragility render it extremely doubtful whether the comparative actual cost in the long run is very much altered. This, of course, is quite absurd, and would pass unchallenged by none save the uninitiated.

Another paragraph reads: "When we come to the comparison of electric light (as produced by arc lamps) and gas, the advantage is altogether on the side of electricity; and in brilliancy of effect, power of illumination, and convenience in lighting large areas, gas can hardly be reckoned as a rival." Gas engineers should consider themselves fortunate that the Street Lighting Committee of the City of London do not share the opinion expressed above. In spite of such testimony to the brilliancy of electric light as produced by arc lamps, it may be worth recording that all the London bridges, as well as the new Victoria Station and the new thoroughfares Kingsway and Aldwych, are brilliantly and cheaply lighted by gas. Many like instances could be quoted as a refutation of the foregoing extravagant statement. A few more facts and a few less opinions would possibly increase the value of this aspiring little pocket-book.

INDUSTRIAL CHEMICAL ANALYSIS.*

The book before us is the first part of a French edition of the comprehensive treatise by Professors Post and Neumann on "Analytical Chemistry in its Application to Industry." The complete work will comprise two volumes, each containing four parts. Judging from the specimen in our hands, each part may for practical purposes be regarded as a distinct book, so that the work will ultimately consist of eight octavo volumes.

A number of authors have collaborated in the production of the German work; and the translator has made some useful additions. There are four chapters in this part. The first, on water and residual waters, is by Dr. J. H. Vogel, of Berlin. As to the treatment of water analysis, the only criticism we need make is that too much space appears to be devoted to the determination of hardness by means of soap solution, and the modern, more exact, and simpler method of Hehner is relegated to quite a subsidiary position. Residual waters from industrial processes are broadly ranged in two classes—viz., those containing mainly organic and those containing chiefly inorganic matter. The inorganic matter is classified according to whether it is principally either salts of the alkalies or alkaline earths, or salts of the heavy metals or free acids; and, naturally, the analytical procedure is dictated to a large extent by the nature of the manufacturing operations from which the residual water comes. Precise rules to cover all cases are out of the question; but Dr. Vogel gives useful indications of the courses which will be found applicable in most instances.

The second chapter is on fuel, and is by Dr. Langbein, of Niederlössnitz, near Dresden. The usual methods for the ultimate analysis of coal, coke, &c., are given, and physical tests are described. The greater part of the chapter, however, treats of the determination of calorific power; and the translator has here introduced some useful original matter dealing with calorimeters of French origin. The third chapter, on "Pyrometry," is by Dr. Neumann himself. It affords an exceptionally complete account of the various systems of pyrometry, and describes the more modern types of pyrometers, whether water, thermo-electrical, or optical. In this chapter also the translator has made some useful additions.

The fourth and final chapter of this part of the work deals with the analysis of gas—including chimney gas, heating gas, gas for power purposes, and fire-damp. It is, like chapter three, by Dr. Neumann. The first portion is devoted to a general account of calorimetric methods and apparatus, the sampling of gases, &c. Next comes a description of various forms of gas analysis apparatus—viz., Hempel's, Bunte's, Villots', Drehschmidt's, Orsat's (with modifications), and a number of special appliances for the determination of fire-damp. We notice that the translator has inserted a description of Coquillon's apparatus for estimating fire-damp in mine air, which is the forerunner of the apparatus devised by Dr. Haldane, and more generally used in English mines. The latter apparatus is not mentioned; nor, so far as we have observed, is the Clowes-Redwood vapour detector, which introduces a different principle. Generally speaking, neither the German authors nor the French translator seem familiar with modern English methods and apparatus for the analysis and detection of inflammable gases. With this qualification, the treatment accorded to gas analysis is good, though readers of the "Journal" may be warned that the analysis of coal gas is only referred to incidentally.

The chapter (and book) conclude with a couple of pages on the determination of the calorific power of heating and power gas. The German author mentioned only the Junkers calorimeter, but the translator has introduced a reference to the use of the Mahler bomb for the calorimetry of gases. There is no reference to the methods and apparatus devised by Professor Threlfall for determining the calorific power and composition of producer gas.

The first part of this work, as now issued, is without an index; but presumably one will be provided for the complete volume. We look forward with pleasure to the issue of the next part, in which illuminating gas, carbide and acetylene, petroleum, oils, and fats will be dealt with. But, as we have indicated, the first part contains much of direct interest to the gas-works analyst; and we cordially commend it to him.

* "Traité Complet D'Analyse Chimique appliquée aux Essais Industriels." Par J. Post, Professeur honoraire à l'Université de Gœttingne, et B. Neumann, Professeur à la technische Hochschule de Darmstadt. Traduite par le Dr. L. Gautier. Second French Edition, translated from the third German Edition, with numerous additions. Vol. I., Part I. Paris: A. Hermann; 1907.

GAS SUPPLY OF ST. GALL.

Two years ago, we were able to give some interesting particulars of the new gas-works established on the shore of Lake Constance for the supply of the town of St. Gall, Switzerland, at a distance of more than 6 miles from the works.* The new works have since been completed; and we have received from Herr Zollikofer, the Engineer of the gas and water undertakings of St. Gall, a copy of a description of the works and the subsidiary gasholder stations, together with a statement of the expenditure upon them. We have also received from him the report and accounts of the concerns for last year.

It will be remembered that the trunk main between the works and the gasholder station is about $6\frac{1}{3}$ miles in length, and $13\frac{1}{2}$ inches in diameter. Five valves are provided, so that in case of repairs being needed, a section can be readily isolated. The necessary pressure for forcing the gas through this trunk main is obtained from two Enke's No. 10 blowers, each capable of delivering 1900 cubic feet of gas per minute at a pressure of 17 inches. There is, moreover, a gain of about 6 inches in pressure *en route*, owing to the gasholder station at St. Gall being some 820 feet above the level of the gas-works. Frequently the natural pressure suffices for driving the gas through the main; and so far the blowers have been little used. The difference in level of the works and town is also responsible for a larger volume of gas being sold than is made—that is to say, the item of unaccounted-for gas disappears from the accounts, because the gas accounted for exceeds the gas made by (in 1906) 1·58 per cent.

The gas undertaking has now settled down to what seems likely to be a normal condition of supply, after the establishment of the new works on Lake Constance and the demolition of the old ones in the town, and the inclusion of a number of small communities, mostly in the vicinity of the new works, in the distributing area. These communities are supplied independently of the high-pressure main; and as they have been served for two years or more, it may be assumed that the rate of increase in the amount of gas sold is now likely to be fairly normal. The past year showed an increase of 7·6 per cent. over 1905. Of the total output of gas, 7·73 per cent. was used for public lighting, 82·76 per cent. was sold to private consumers in St. Gall, 1·37 per cent. in Goldach, 7·05 per cent. in Rorschach, and 0·44 per cent. in Arbon. Of the private consumption in St. Gall, 52·4 per cent. was in the summer months, when the price was 18c. per cubic metre; and 47·6 per cent. in the winter, when the price was 25c. per cubic metre. Thus the average price obtained for the gas was 21·33c. per cubic metre, or (say) 4s. 10d. per 1000 cubic feet. The cost of coal delivered at the railway station at Horn (which is connected by rail with the new gas-works) averaged 32·54 frs. per metric ton. Much difficulty was experienced, however, in getting the customary supply of coal from Germany, and some was obtained from England by way of the Rhine. But the freight charges by this route have been increased, and it is hoped it may shortly be possible to obtain English coal at a moderate rate of freight by way of Genoa or Marseilles. It is now recognized in Switzerland that it is unsafe to depend on the German coal mines, or on the German railways or waterways, for a regular supply of coal at reasonable prices.

The profit on the gas undertaking for the year was 603,043·95 frs.; and after paying interest on the capital, and making contributions to the sinking fund, the sum of 140,000 frs. (about £5600) has been handed over to the town in relief of the rates.

Some tests have been made on the flow of gas through the high-pressure main between the works and the town by Herr Zollikofer, in collaboration with Dr. A. Fliegner, of Zürich. An account of them is in course of publication by the latter gentleman; and we hope to give an abstract of his conclusions in an early issue.

* See "Journal," Vol. XCI., pp. 372, 378.

On the 18th inst., the marriage was solemnized, at St. Jude's South Kensington, by the Rev. Prebendary E. A. Eardley-Wilmot, M.A., Vicar, assisted by the Rev. G. W. Gillingham, brother of the bridegroom, of Mr. James Searle Gillingham, of the Royal Corps of Naval Constructors (son of the late Mr. J. Gillingham and Mrs. Sharland, of Forest Hill), to Rose Mary, eldest daughter of Mr. and Mrs. Henry J. Robus, of Cromwell Road, South Kensington.

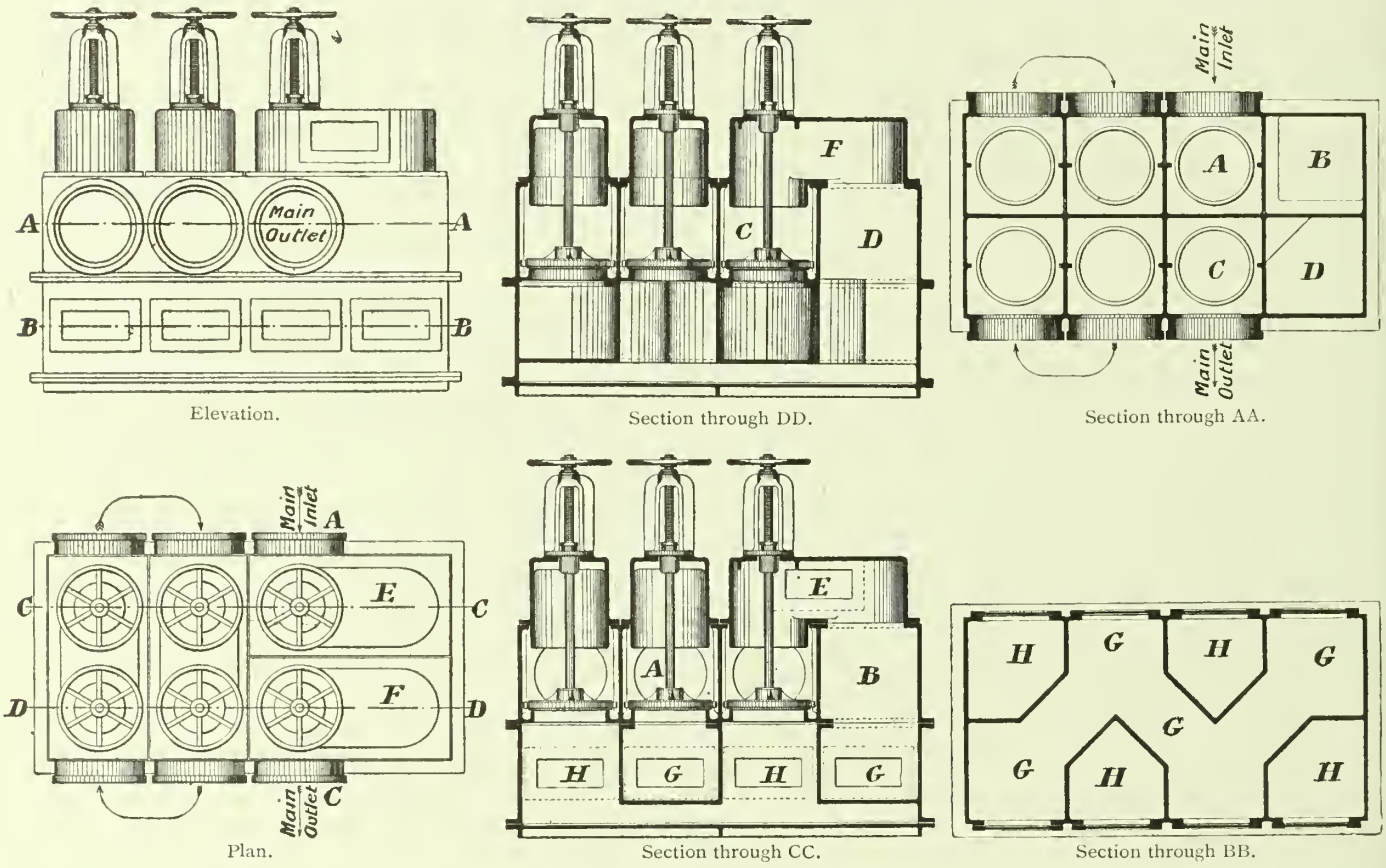
The death occurred, on Monday last week, of Dr. August Dupré, the Chemical Adviser in Explosives to the Home Office. He studied chemistry under Bunsen at Giessen and Heidelberg. Deceased, who was elected a Fellow of the Royal Society in 1875, published a number of original papers dealing chiefly with problems of chemical analysis, especially of water and food. He was a Fellow of the Institute of Chemistry, and President of the Society of Public Analysts in 1877-8. He was in his 72nd year.

REVERSING THE FLOW OF GASES THROUGH CONDENSERS AND PURIFIERS.

In these days, when engineers are considering the advisability of reversing the flow of gas through condensers and also through purifiers, it is of interest to note the latest means by which this can be brought about. We herewith give some illustrations of a reversible valve on the "Weck" system recently provisionally protected by Messrs. Robert Dempster and Sons, Limited, of Elland.

The illustrations show a valve suitable for working two condensers or two purifiers either in the usual way—that is, entering the apparatus named through the inlets and leaving through the outlets—or reversing the gas and entering the apparatus through the outlets and leaving through the inlets. In the first case, the gas must travel in one given direction (say, from right to left); in the other case, of course, the gas travels from left to right. Besides reversing the flow of the gas, the valve can be worked in the same manner as an ordinary centre-valve—that is, either one box or two boxes can be worked; but, in addition, both boxes can be bye-passed entirely by means of the valve. Although the illustrations show the valve suitable for two boxes only, it can be made for three, four, or even more boxes, and can be made in sections, if found more convenient, and bolted direct to either the condensers or the purifiers.

The difference between this valve and the ordinary type of valve consists in adding two more compartments to an ordinary valve, and fixing the main inlet and outlet sockets on the same level as the connections to the boxes to be worked, instead of below, as is usual. Connection is then made between the main inlet socket A and one of the extra compartments B, and between the main outlet socket and the other extra compartment D, by the usual hoods E and F over the top of the valve. The extra compartment B, communicating with the main inlet-socket A through the hood or connection E, also communicates with the



Dempster's Patent Reversible Valve.

main outlet chamber G in the bottom part of the valve, while the extra chamber D communicating with the main outlet socket C through the top hood F of the valve, also communicates with the main inlet portion of the valve H below. Thus, to bye-pass the valve altogether either the main inlet or else the main outlet valve is raised to the top seat, and the remainder shut down. The gas will then have to travel straight through from the main inlet to the main outlet socket without entering either the condensers or the purifiers. To work boxes Nos. 1 and 2 in the usual way through the inlets, the main inlet and main outlet valves should be raised to the top seat, and also the inlet valve to No. 1 box and the outlet valve from No. 2 box. In this case, the gas will flow through No. 1 box and then through No. 2 box and away. Or to work No. 1 box only, the main inlet and outlet valves and the inlet and outlet valves to No. 1 box should be opened to the top and the remainder of the valve shut down. No. 2 box would, of course, be worked in a similar manner by opening the valves belonging to that box instead of those belonging to No. 1 box. To reverse the flow of the gas, and to work Nos. 1 and 2 through the outlets, instead of through the inlets, the main inlet and outlet valves should be shut down on the bottom seats; the main outlet to No. 1 and the main inlet to No. 2 box shut down on the top seat; and all the other valves shut down. The gas would then pass straight from the main inlet socket into the main outlet chamber and enter No. 1 box through the outlet, come back to the valve through the inlet, go to No. 2 box through the outlet; come back to the valve through the inlet, where it would drop into the main inlet chamber; and away by the hood F through the main outlet socket C.

The valve itself is a very simple one, and of the design now generally understood throughout the country, both of which points should recommend it to the notice of gas engineers.

ACCOUNTS OF LOCAL AUTHORITIES.

Departmental Committee's Report.

Readers will doubtless remember that quite early last year a Departmental Committee was appointed by the President of the Local Government Board (Mr. John Burns) to inquire and report with regard to (1) the systems on which the accounts of local authorities in England and Wales are at present kept; (2) generally as to the system on which these accounts should be kept, and in particular whether they should be prepared on a system requiring the entries of receipts and payments to be confined as far as possible to actual receipts and payments of money or not; and (3) the regulations which should be made on the subject, regard being had to the necessity for showing accurately the amounts raised by local taxation and the purposes for which they are applied. The Committee consisted of Messrs. Walter Runciman, M.P. (Chairman), John Bromley, C.B., Thomas Pitts, C.B., Richard Barrow, Edmund Pearse Burd, John Joseph Burnly, John Gane, and Frederick Merrifield. Mr. George Rutland Snowden was appointed Secretary. The Committee held forty meetings and heard evidence from twenty-eight witnesses, of whom six were District Auditors and fourteen were nominated by the Associations of Poor Law Unions, Rural and Urban District Councils, Municipal Corporations, County Councils, the London County Council, the Institute of Municipal Treasurers and Accountants, the County Accountants' Society, the Society of Accountants and Auditors, and the Institute of Chartered Accountants. The first report of the Committee was issued last Thursday. It is signed by all the members; but Mr. Pitts adds a memorandum in which he mentions certain points in regard to which he differs from his colleagues.

The report is divided into three parts. Part I. deals with the

systems on which the accounts of local authorities are at present kept; and the conclusion arrived at by the Committee is that they are not kept on any uniform system. The chief causes of this want of uniformity are stated to be (*a*) the vague terminology of Acts of Parliament, (*b*) absence of sufficiently precise regulations and definitions, and (*c*) the increasing sense of the inadequacy of the purely cash system of keeping accounts. The Committee say there is little uniformity in regard to the form in which the abstracts of the accounts are presented to the ratepayers; and as the returns and financial statements furnished to the Local Government Board are compiled from data derived from different systems of accounts, the statistical information obtained is not uniform.

In Part II. of the report, the Committee set forth the system in which the accounts of local authorities should be kept. This is the most important part of their report; and the conclusions at which they have arrived are summarized as follows:—

(*a*) The most efficient system of account-keeping suitable for general application to local authorities is a system of income and expenditure, on which all incomings and outgoings pertaining to any given period, whether actually received and disbursed or not, are included in the accounts of that period.

(*b*) As regards rate fund accounts generally, the Committee understand that the existing law with regard to rating is such that it is not practicable at present to admit into the accounts proportionate parts of items of income and expenditure which have not actually become due for receipt or payment before the close of the financial period.

(*c*) The accounts of Overseers of the Poor, and a few classes of small authorities, are of such a character that they may continue to be limited, as heretofore, to receipts and payments of cash.

(*d*) Both for rating estimates and for statistics, a more satisfactory basis is afforded by the system of income and expenditure than by a system of cash receipts and payments.

(*e*) The actual scheme of book-keeping must necessarily be adapted to the requirements of the several authorities; but in every case it should be designed to present the accounts of the various transactions through all their stages, from first to last, in a continuous and coherent connection.

(*f*) The ledger should contain a systematic and comprehensive record of all the channels of income and expenditure, so classified that when balanced it will lead up to a clear and accurate statement of the financial position.

(*g*) Stores accounts should form an integral part of the book-keeping, and should be so framed as to afford complete touch with the materials, from their purchase to their consumption. Efficient supervision in regard to materials can only be maintained by a full system of accounts, supported by thorough and regular stocktaking, carried out independently of the officer in charge of the materials.

(*h*) Accurate and complete cost accounts should be kept in every case where an authority carries on works by direct labour.

(*i*) In respect of all trading undertakings, as defined in paragraph 65,* separate revenue accounts, net revenue accounts, and balance-sheets should be prepared.

(*k*) The balance-sheets of the several funds should be divided into separately balancing sections, and should include, as far as possible, a complete record of all assets and liabilities. These balance-sheets should finally be incorporated into an aggregate balance-sheet showing in summary the financial position of the authority as a whole.

(*l*) With regard to the depreciation of assets, the amount to be provided in any case depends necessarily on the nature of the asset itself and the special conditions attaching to it, and cannot be regulated by a general standard or scale. The repayment of debt, so far as it goes, may properly be regarded as provision for depreciation. But it is possible that the period allowed for repayment may be excessive; and therefore in some cases further provision for depreciation may be necessary.

(*m*) All assets having an abiding or realizable value, including the whole of the assets and capital outlays in respect of each trading undertaking, should be maintained in the balance-sheets at their original cost, so long as they remain in the possession of the authority. Other capital and loan expenditures—*e.g.*, on street improvements or sewers—should be written down by the amount of the provision made for the repayment of the debt.

(*n*) In regard to the financial relations of the various departments of an authority and other kindred matters, many important questions arise which cannot be settled or controlled by general regulation. The Committee recommend that all authorities of sufficient importance should be required by statute to appoint Finance Committees with general powers of control over all matters of finance and account.

(*o*) Wherever practicable, the account-keeping should be in the hands of officers who are not responsible for pecuniary transactions or administrative duties.

(*p*) Uniformity should be insisted upon, by means of regulation in regard to the general system on which the accounts should be kept.

(*q*) Complete uniformity in the presentment of accounts to ratepayers is not attainable. But it is important that the accounts should be published in a simple and easily intelligible form; and the more important authorities should also prepare fuller abstracts of their accounts for the use of ratepayers who require further information.

Part III. of the report deals with the regulations which the Committee consider should be made in regard to the accounts of local authorities. As to the more important trading undertakings of local authorities, the Committee say the regulations should provide that the results of the actual working of the undertaking, apart from loan charges, should first be shown in the revenue account, and that the loan-service and other charges not directly attributable to working should be dealt with in a separate net revenue account, which should also set out the manner in which the surplus or deficiency shown therein is treated, in accordance with the statutory requirements governing the case, and the resolution of the authority made thereunder. Separate balance-sheets should also be prepared in respect of these undertakings.

The Committee also consider that the regulations should aim at securing that reliable and uniform principles shall in all cases govern the statement of profit or loss; and the following are special points which they say should be observed in connection with these principles:—

(1) That the capital accounts are charged with true capital expenditure only, and that the decision of the loan-sanctioning authority in regard to the spreading of expenditure over a period of years is duly followed in all cases.

(2) That no valuations or appraisements of the assets are included, but that the capital outlays are maintained at their original amounts, and that the provisions made to date towards covering the cost or repaying the debt are shown *per contra* upon the balance-sheet.

(3) That the repairs and replacements of plant are charged to revenue or reserve fund in all cases, except where the original loan in regard thereto has been discharged and a further loan sanctioned.

(4) That the accounts show what provision (if any) has been made in the way of reserve, under the statutory clauses relating thereto, for meeting any special burdens which may arise in connection with replacement of plant or otherwise; and that funds which are not really available for this purpose, but are in fact required as a working balance, are not returned as reserves.

(5) That the accounts show clearly what provision has been made to cover bad debts on any uncollected income included in the accounts.

(6) That all costs connected with the undertaking are charged thereto, including a fair share of common charges which concern the management of the undertaking, all law and parliamentary costs, all bank charges, discounts, and expenses in respect of the issue of stock, and other financial charges.

(7) That the accounts include the full amount of all running charges or income accrued during their period, such as the proportion of all loan-service charges accruing between the last date for payment and the close of the account.

(8) That the accounts of the period are charged with their proper share of loan repayment or sinking fund provision in respect of all expenditure charged upon loan account, and that the incidence of this burden is not deferred by delay in taking up loans or by meeting capital expenditure by bank overdraft. A proper share of the expenditure should be charged to the revenue account in cases where unavoidable delays arise in obtaining the loans.

(9) That where capital expenditure relates to other matters in addition to trading undertakings, or to more than one undertaking—*e.g.*, to tramways and street improvements, or to electricity and dust destruction—a reliable and, if possible, independent apportionment of the burden shall be obtained.

(10) That where transfers have to be made in respect of services rendered by one department to another, as in the case of gas or electric current supplied for the lighting of streets, sufficient data are provided to establish the fair and reasonable nature of the charge.

On the subject of the published abstracts and financial statements, the Committee express the opinion that the regulations should deal with the form in which the abstracts are to be published; for they regard it as highly desirable that one pattern for each class of authority should be followed in the outline and arrangement, with the view of making the abstracts as useful and easy of comprehension as possible to all persons interested therein. In the schedules to the report are given standard forms of abstracts of electricity, gas, water, and tramway accounts which the Committee believe will be suitable for publication by local authorities who possess these undertakings;* and they consider that clear regulations on the lines indicated will not only secure the preparation of the accounts on uniform principles and their publication in an easily intelligible form, but furnish both the staff of the authority and the auditors with adequate means for verifying their accuracy and completeness.

In conclusion, the Committee draw attention to certain points on which some alteration of the existing statutes may be involved in giving the fullest effect to their recommendations. In the first place, they think it desirable that the systems of account for all local authorities should be prescribed by one central authority. Next, the general appointment of Finance Committees and the settlement of their functions in regard to financial questions may call for some amplification of the existing provisions. The two following points with regard to the law of rating touch the fringe of much wider questions; and therefore the Committee's suggestions are based only upon considerations of accountancy. They understand that, under the existing law with regard to rating, the complete system of income and expenditure cannot be applied to funds which consist mainly or entirely of rates. In their opinion, the ratepayer of any given year should be charged with the "expenditure" of that year—*i.e.*, with the total cost of the year's operations, so far as it can be estimated in advance, and so far as it is not authorized by sanctions of loans to be spread over a series of years. The other point is that considerable simplification of accounts, and greater uniformity, could, the Committee think, undoubtedly be obtained by a general unification of the existing systems of rating and assessment.

* The Committee explain, in the paragraph referred to, that the term "trading undertakings" may be taken to mean gas-works, water-works, electricity, tramway, and light-railway undertakings.

* We reproduce on pp. 230-31 the proposed standard form of abstract of gas-works accounts.

STANDARD FORM OF ABSTRACT OF GAS-WORKS ACCOUNTS FOR PUBLICATION BY LOCAL AUTHORITIES.

[See Report of Departmental Committee on p. 228.]

(*Name of Local Authority.*)

(*Title of Order or Act under which the Undertaking was established by the Local Authority.*)

I.—STATEMENT AS TO BORROWING POWERS.

Borrowing Powers Authorized.			Borrowing Powers Exercised.	Borrowing Powers Remaining to be Exercised.
Act, Order, or Sanction.	Period of Loan.	Amount.		
		£	£	£

II.—REVENUE ACCOUNT for Year ended _____, 19 .

Dr. *Cr.*

Expenditure.	£ s. d.	£ s. d.	£ s. d.	*Income.*	£ s. d. Corporation Depts.	£ s. d. All other Consumers.	£ s. d.
MANUFACTURE OF GAS.							
1. Carbonization—							
Coal and all expenses of depositing same on works				SALE OF GAS—			
Wages of stokers				1. Private Consumers			
2. Purification—				2. Public Lamps.			
Wages							
Materials, water, and other expenses . .							
3. Salaries of officials—							
Engineers, Superintendents, and Officers at Works				Total in respect of Gas Sales			
4. Repairs and Maintenance—							
Buildings				RESIDUAL PRODUCTS—			
Plant, including Retorts and Apparatus .				3. Coke			
5. General Charges—				4. Tar.			
Oil, water, waste, and engine-room stores				5. Ammoniacal Liquor			
RESIDUAL PRODUCTS—				6. Other products			
6. Charges in connection therewith . . .							
DISTRIBUTION OF GAS—							
7. Salaries of Engineers, Inspectors, and Assistants				RENTALS OF METERS, FITTINGS, AND STOVES—			
8. Wages of meter inspectors				7. Meters.			
9. Repairs and maintenance:—				8. Fittings			
(*a*) Mains and services				9. Stoves			
(*b*) Meters							
PUBLIC LAMPS—							
10. Lighting and repairing				PUBLIC LAMPS—			
				10. Lighting and Repairing			
RENTS, RATES, AND TAXES—							
11. Rents, wayleaves, and easements. . .							
12. Rates and taxes							
MANAGEMENT AND GENERAL EXPENSES—							
13. Salaries of Engineer, Manager, Secretary, and Office Staff (not charged elsewhere)				SUNDRY REVENUE—			
14. Proportion of salaries and establishment expenses of Town Clerk's, Treasurer's, and other departments				10. Works executed for customers, and goods sold .			
15. Salaries and expenses of collectors separately appointed				11. Rents, wayleaves, and easements			
16. Printing, stationery, and advertising . .				12. Miscellaneous			
17. Other establishment charges				.....			
18. Law charges				.....			
19. Insurances and compensations . . .							
20. Miscellaneous.							
GAS STOVES AND FITTINGS—							
21. Stoves and fittings							
22. Wages and materials				Gross income			
SUPERANNUATION—							
23. Allowances to officers and servants . .				*Less*—Discounts and other allowances			
Total amount of working expenses . .				Bad debts written off			
Balance carried to net revenue account (No. III.)							

Note.—It will be understood that additional items may be inserted in these forms, where required, provided the general classification is preserved.

III.—NET REVENUE ACCOUNT for Year ended _____, 19 .

Dr. *Cr.*

Expenditure.	£ s. d.	£ s. d.	*Income.*	£ s. d.
To interest on loans (including income-tax).			By Balance 1st April, 19 , brought forward	
,, loans funds, redemption funds, and sinking funds—Amount transferred thereto			,, Revenue account (No. II.)—Amount transferred therefrom	
,, Instalments of loans.			,, Bank interest	
,, Parliamentary expenses			,, Borough (or District) fund—Amount of deficiency (if any) transferred therefrom	
,, Renewals fund—Amount transferred thereto . . .				
,, Reserve fund—Amount transferred thereto. . . .				
,, Borough (or District) fund—Amount transferred thereto in aid of rates				
Balance (if any) at 31st March, 19 , to be carried forward				

Dr. **IV.—SINKING FUND ACCOUNT for year ended _____, 19 .** *Cr.*

Expenditure.	£ s. d.	£ s. d.	*Income.*	£ s. d.
To Redemption of Loans—			By Balance, 1st April, 19 , brought forward	
.....			,, Dividends on Investments	
.....			,, Net Revenue Account—Amount transferred therefrom	
Balance, 31st March, 19 , to be carried forward				

Dr. **V.—RENEWALS FUND ACCOUNT for year ended _____, 19 .** *Cr.*

	£ s. d.	£ s. d.	*Income.*	£ s. d.
To Renewals, viz.—			By Balance, 1st April, 19 , brought forward	
Balance, 31st March, 19 , to be carried forward			,, Dividends on Investments	
			,, Net Revenue Account—Amount transferred therefrom	

Dr. **VI.—RESERVE FUND ACCOUNT for year ended _____, 19 .** *Cr.*

	£ s. d.	£ s. d.	*Income.*	£ s. d.
To Amounts applied (*specifying them*)—			By Balance, 1st April, 19 , brought forward	
.....			,, Dividends on investments	
.....			,, Net Revenue Account—Amount transferred therefrom	
Balance, 31st March, 19 , to be carried forward				

Dr. **VII.—CAPITAL ACCOUNT, year ended _____, 19 .** *Cr.*

Expenditure.	To 31st March, 19 .	From 1st April, 19 , to 31st March, 19 .	Total.	*Loans and Credits.*	To 31st March, 19 .	From 1st April, 19 , to 31st March, 19 .	Total.
	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.
To acquisition of undertaking where acquired from Company				By Loans Raised, viz.—			
,, Land				Stock—			
,, Buildings				.....			
,, Manufacturing plant, machinery, &c.				.....			
,, Mains and services				Mortgages—			
,, Meters				.....			
,, Stoves				.....			
,, Offices and depôts				Annuities (capitalized value)—			
,, Office furniture				.....			
,, Parliamentary expenses				.....			
,, Preliminary expenses				[*The basis on which the value is arrived at should be stated.*]			
Balance unexpended at 31st March, 19				,, Revenue Contributions to Capital—			
				.....			
				.....			
				,, Other Items, viz.—			
				Note.—The proceeds of realizations or sales of property should be shown as deductions from the specific items on the other side of the account, where statutory provisions do not prescribe a different treatment.			

VIII.—BALANCE-SHEET as at _____, 19 .

Liabilities.	£ s. d.	£ s. d.	*Property Assets and Outlay.*	£ s. d.	£ s. d.
Loans—			Capital Outlay as per Capital Account—		
Stock (at par value)			Acquisition of undertaking where acquired from Company		
Mortgages			Land		
Annuities (capitalized value)			Buildings		
[*The basis on which the value is arrived at should be stated.*]			Manufacturing plant, machinery, &c.		
Sundry Creditors—			Mains and services		
.....			Meters		
.....			Stoves		
.....			Offices and depôts		
Total liabilities			Office furniture		
Renewals Fund—			Parliamentary expenses		
(Balance at credit thereof)			Preliminary Expenses		
Reserve Fund—					
(Balance at credit thereof)				£ s. d.	
Net Revenue Account—			Works in progress—		
(Balance at credit thereof)			.....		
Revenue Contributions to Capital			.....		
Redemption of Debt—			Stores on Hand—		
Debt extinguished			.....		
Sinking fund available			.....		
			Investments (at cost)—		
			.....		
			.....		
			Sundry Debtors—		
			.....		
			.....		
			Cash—		
			.....		
			.....		

COMPARISONS OF LIGHT-STANDARDS.

REPORT MADE BY THE NATIONAL PHYSICAL LABORATORY TO THE INSTITUTION OF GAS ENGINEERS.

[Presented by Mr. C. C. Paterson to the International Photometric Committee at Zurich last Thursday.]

In the comparisons which have been made at the National Physical Laboratory between the Pentane, Hefner, and Carcel lamps, special precautions have been taken to use them, as far as could be ascertained, in accordance with the regulations and practice observed in the countries where they are employed as standards. Details as to the methods of use and the precautions taken when burning the lamps are given in this report.

Lamps Used in Tests.

Two Carcel and two Hefner lamps (the latter certified by the German Reichsanstalt) were employed in the tests, and were compared against the standard 10-candle pentane lamp at the National Physical Laboratory. This lamp, which, in all its dimensions, agrees accurately with the specification and has passed the Gas Referees' examination, is used in the course of ordinary laboratory test work for the purpose of standardizing other pentane lamps which are sent from time to time to be tested. The comparisons during 1904 and 1905 between this standard and lamps from different makers are given below, for the purpose of showing the smallness of variations occurring in different lamps made to the same specification, and also to show that the pentane lamp used for these comparisons may safely be taken as having a value of exactly 10 candles.

Pentane Lamp.	Candle Power when compared against National Physical Laboratory Standard Lamp.
A	9·96
B	10·00
C	9·98
D	9·98
E	10·05
F	10·00
G	10·00
Average	10·00

General Conduct of Test.

As part of the equipment of the photometric department, a large number of electric carbon filament lamps have been carefully calibrated against the standard pentane lamp under circumstances which are described later. These electric lamps form the primary working standards of the Laboratory, and are checked from time to time among themselves and also against the 10-candle lamp. Some are burnt only once or twice a year, and others more frequently; but none are used for more than 5 or 10 minutes at a time. The candle power of these is known accurately in terms of the pentane unit, and they have been used in all cases as a means of intercomparison between three flame-standards. The pressure on these is adjusted by the potentiometer.

The "double comparison" method has been employed in all the daily observations which have been made. That is to say, an electric lamp, selected on account of the suitability of its light colour, is first calibrated against the primary electric standards in terms of the 10-candle pentane lamp. This lamp remains on the bench while the primary standard is replaced by the flame lamp to be tested, and measurements of candle power are made on it. The comparison lamp is checked each day against the primary standards, and is only assumed to remain constant for the few hours during which the test is in progress. By this means the "personal error" in judging the correct position of the balance is eliminated, as well as any possible error which may result from differences in reflection from the screens surrounding the lamps at the two ends of the bench. In measuring the Carcel and pentane lamps against the electric standards, the illumination on the photometer screen was 10 candle-metres (about 1 candle-foot). This had to be reduced in the case of the Hefner lamp to about one-third of a candle-metre, on account of the small candle power of the amyl-acetate lamp. Special precautions were taken to ensure thorough ventilation of the photometer-room immediately before the readings were taken, and freedom from draughts when the observations were in progress.

Variations of Candle Power with Changes in Atmospheric Conditions.

It is now universally recognized that the candle power of flame-standards varies to a considerable extent according to the amount of humidity present in the atmosphere, and also with changing barometric pressure. This was first definitely shown by the researches of Herr Liebenthal at the Reichsanstalt, which were published in 1895. His experiments were made on the Hefner lamp and the 1-candle Woodhouse and Rawson pentane standard. The results of these formed the basis upon which the candle power of the Hefner lamp was taken as unity, with a humidity of 8·8 litres of moisture per cubic metre of pure air. In the standardization of the National Physical Laboratory primary electric standards referred to above, a similar set of experiments has been made on the 10-candle power Harcourt lamp, with the object of determining, in the same way, its variation with humidity and barometer; and a water vapour content of 10 litres per cubic metre has been fixed upon as the humidity at which the lamp has its nominal value of 10 candles. [Ten litres per cubic metre is the mean humidity for five years observed at the Meteorological Office in Victoria Street, London, and at the National Physical Laboratory's Department at Kew.]

In view of the fact that these standard humidities are different in Berlin and London, it was not sufficient for our measurements merely to compare the lamps on the same day, regardless of the humidity value—even if the latter could have been assumed to remain constant during the experiment, and the correcting factor the same for all the lamps—but the change in candle power of each lamp with atmospheric moisture had to be determined independently, and the candle power deduced at standard humidity and barometer by means of the formula obtained from all the observations.

In the use of all the three lamps the readings were not taken till 40 minutes after lighting up. The photometer room was thoroughly ventilated; observations being made during the first 20 minutes after shutting the windows and doors.

Results of Experiments.

The results of these measurements are shown graphically for the pentane, Hefner, and Carcel lamps respectively in diagrams, figs. 1, 2, and 3. The scales are the same for all three lamps; so that the curves are comparable at sight. The humidity content of the air is plotted as abscissa; and the candle power of each lamp, in terms of the 10-candle pentane unit, is plotted vertically as ordinates—observations having been previously corrected to a barometric pressure of 760 mm. of mercury. The humidity and barometer correcting factors have been obtained by the method of least squares from all the observations plotted in figs. 1 and 2.

It is a matter of regret to us that, owing to the session of the International Commission in June, we are unable, in the case of the Hefner and Carcel lamps, to embody the results of comparisons at higher humidities in this report. The maximum humidity obtainable up to the middle of May has been 12 litres per 1000. In view, however, of the fact that the humidity factor found for each Hefner lamp independently (see the curves on the right-hand side of fig. 2) is so nearly the same, we are of opinion that observations over a still wider range will not materially alter its amount. It may be pointed out here, however, that, as our observations all lie in the neighbourhood of the standard humidity (8·8 litres), the absolute correctness of this factor will not affect the value given for the ratio between the candle power of the two lamps. The correcting formula for humidity in the case of the Hefner lamp is

$$\text{Candle power (Hefner units)} = 1{\cdot}000 + 0{\cdot}0066\,(8{\cdot}8 - \epsilon)$$

where ϵ = litres of water vapour per cubic metre of pure air.

The values shown on fig. 1 for the pentane lamp were made at intervals over a period of two years, and give the same constant—viz.,

$$\text{Candle power (pentane units)} = 10 + 0{\cdot}066\,(10 - \epsilon)$$

where ϵ = litres of water vapour per cubic metre of pure air.

As regards the correction for barometer, the following values were obtained for the two Hefner lamps:—

$$\text{Candle power (Hefner lamp No. 1117)} = 1{\cdot}000 - 0{\cdot}00030\,(760 - b)$$

and

$$\text{Candle power (Hefner lamp No. 960)} = 1{\cdot}000 - 0{\cdot}00012\,(760 - b)$$

where b = reading of barometer in mm.

The slight discrepancy in these constants is undoubtedly due to the smallness of the correction, coupled with the comparatively small range of barometric pressure over which we were able to observe the lamp. If a mean factor 0·0002 be accepted, the difference in the candle power between this and the factor 0·00012 for a 20 mm. change in barometer amounts to under 0·2 per cent.; the total correction being about $\frac{1}{2}$ per cent. for 25 mm.

The barometric correcting formula for the pentane lamp is:—

$$\text{Candle power (pentane units)} = 10 - 0{\cdot}008\,(760 - b).$$

So that, combining all the formulæ given above:

$$\text{Candle power (Hefner lamp in Hefner units)} = 1{\cdot}000 + 0{\cdot}0066\,(8{\cdot}8 - \epsilon) - 0{\cdot}0002\,(760 - b)$$

$$\text{Candle power (pentane lamp in pentane units)} = 10{\cdot}00 + 0{\cdot}066\,(10 - \epsilon) - 0{\cdot}008\,(760 - b)$$

From the curves shown in figs. 1 and 2, it will be seen that the ratio of the pentane lamp burning in an atmosphere containing 10 litres of moisture per 1000 to that of the Hefner lamp burning in air containing 8·8 litres per 1000 is—

$$\frac{\text{Pentane}}{\text{Hefner}} = \frac{10}{0{\cdot}914} = 10{\cdot}95.$$

That is to say, if the pentane lamp be taken as giving 10 candles, the Hefner lamp will have a value of 0·914.

In addition to the direct comparison between the Hefner and pentane lamps (details of which are given in the foregoing report), we have had occasion to compare the Hefner lamp as used in the Reichsanstalt with the pentane lamp as used at the National Physical Laboratory, through the medium of some electric lamps which have been standardized at both Institutions. These, though not entirely consistent, point to a ratio of pentane to Hefner which is somewhat greater than 10·95. Arrangements

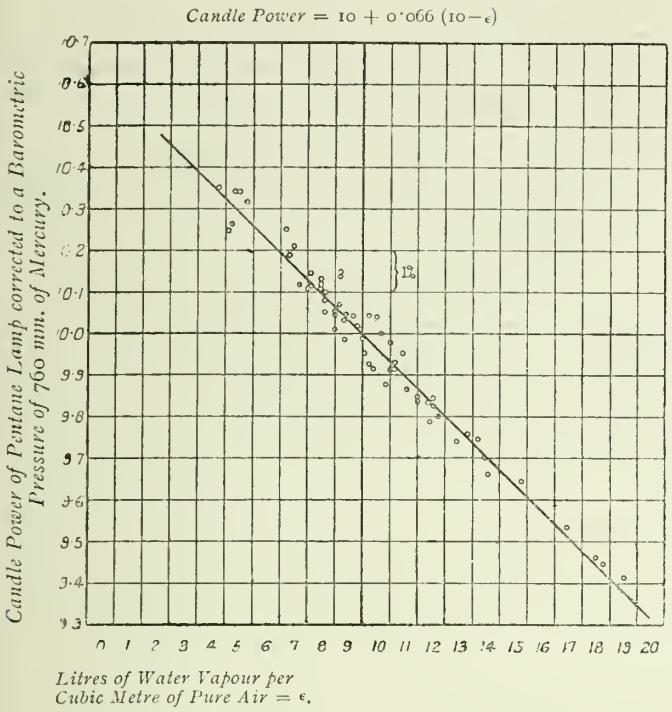


Fig. 1.—Ten-Candle Harcourt Pentane Lamp—Variation of Candle Power due to Humidity.

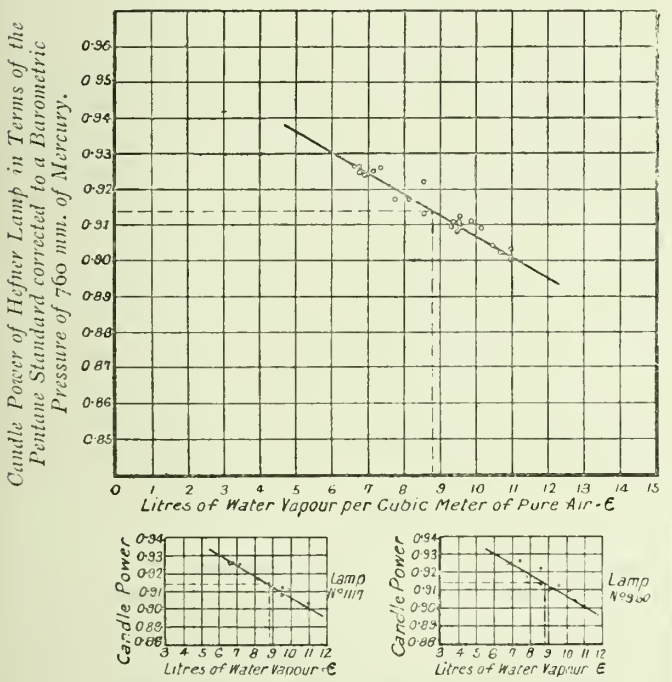


Fig. 2.—Hefner Lamp—Variation of Candle Power due to Humidity.

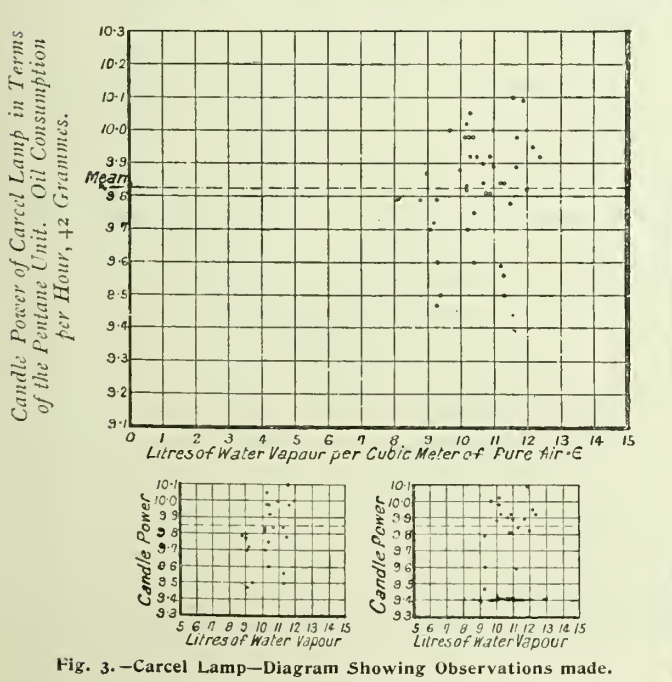


Fig. 3.—Carcel Lamp—Diagram Showing Observations made.

have been made for a further direct comparison through some standardized lamps which Mr. Paterson proposes to take to Berlin, and we hope to communicate further with the Institution when the matter has been investigated.

Tables are appended showing in Column 1 the candle power of the pentane and Hefner lamps as observed, in Column 2 the candle power when corrected by the formulæ for humidity and barometer, and in Column 3 is given the percentage deviation of the observed value from that which would be obtained by the use of the correcting formula—these figures being a measure of the accuracy of observation in the experiments.

TABLE I., *Giving the Observed and Corrected Values for the 10-Candle Harcourt Pentane Lamp from December, 1903, to March, 1905.*

(1.) Observed Value of Candle Power.	(2.) Candle Power Corrected for Humidity and Barometer.	(3.) Percentage Difference Between Value Given by the Formula and Observed Value.	(1.) Observed Value of Candle Power.	(2.) Candle Power Corrected for Humidity and Barometer.	(3.) Percentage Difference Between Value Given by the Formula and Observed Value.
9·86	10·04	+0·4	10·14	9·99	−0·1
9·64	10·02	+0·2	10·15	10·00	0
9 91	10·04	+0·4	10·35	9·99	−0·1
9·89	10·03	+0·3	10·30	9·99	−0·1
9·97	10·00	0	9·79	10·00	0
9 88	10 04	+0·4	9·90	9·98	−0·2
9·86	10·05	+0·5	9·79	10·00	0
10·01	9·99	−0·1	9·78	9·99	−0·1
10·01	10·01	+0·1	10·05	9·99	−0·1
10·00	10·01	+0·1	9·84	9·98	−0·2
9·92	10·04	+0·4	9 76	10·01	+0·1
9·97	10·00	0	9·97	10·03	+0·3
10·20	9·95	−0·5	10·20	9 99	−0·1
10·19	9·95	−0·5	10 01	10·02	−0·2
10·10	9·99	−0·1	9·76	10·01	+0·1
10·06	9·99	−0·1	10·15	10·03	+0·3
10·04	10·04	+0·4	9·84	10·01	+0·1
10·37	10·00	0	9·80	9·85	−0·5
10·27	10·05	+0·5	10·06	10·04	+0·4
10·29	10·04	+0·4	9·83	9·98	−0·2
10·34	9·97	−0·3	9·75	10·00	0
10·36	9·98	−0·2	9·69	9·97	−0·3
10·36	9·98	−0·2	9·46	10·02	+0·2
10 25	9·96	−0·4	9·43	10·01	+0·1
10·10	10·05	+0·5	9·41	10·05	+0·5
9·98	9·98	−0·2	9·82	10·01	−0·1
9·98	9·96	−0·4	9·69	10·03	+0·3
9·92	9·97	−0·3	9·54	10·03	+0·3
9·98	9·95	−0·5	9·88	9·95	−0·5
10·20	10·01	+0·1	9·81	9·96	−0·4
10·21	9·99	−0·1	9·86	9 97	−0·3
9·85	10 03	+0·3	10·08	10·00	0
9·89	10·00	0	10·10	10·04	+0·4
10·08	9·99	−0·1	10·15	10·04	+0·4
10·06	10·00	0	9 92	9·98	−0·2
9·60	10·03	+0·3	9·80	10·02	+0·2
10·16	9·97	−0·3	10·01	10·07	+0·7
9·94	10·02	+0·2	10·13	10·04	+0·4
9·97	10·01	+0·1	10·03	10·02	+0·2

TABLE II., *Giving the Observed and Corrected Candle Power Values for the Hefner Lamps from February to May, 1905.*

(1.) Observed Value of Candle Power.	(2.) Candle Power Corrected for Humidity and Barometer.	(3.) Percentage Difference Between Value Given by the Formula and Observed Value.	(1.) Observed Value of Candle Power.	(2.) Candle Power Corrected for Humidity and Barometer.	(3.) Percentage Difference Between Value Given by the Formula and Observed Value.
0·919	0·915	+0·1	0·916	0·912	−0·2
0·911	0·912	−0·2	0·902	0·908	−0·6
0·905	0·917	+0·3	0·906	0·915	+0·1
0·915	0·917	+0·3	0·915	0·917	+0·3
0·914	0·918	+0·4	0·912	0·919	+0·5
0·911	0·914	0	0·912	0·914	0
0·913	0·914	0	0·925	0·921	+0·7
0·904	0·914	0	0·913	0·912	−0·2
0·927	0·912	−0·2	0·902	0·914	0
0·922	0·913	−0·1	0·925	0·912	−0·2
0·928	0·913	−0·1	0·927	0·912	−0·2
0·917	0 911	−0·3	0 923	0·916	+0·2

Great difficulty has been experienced in obtaining consistent results from the Carcel lamp. Efforts were first made to use the lamp in accordance with the printed instructions, having the wick 10 mm. above the wick-holder and the chimney neck 7 mm. above the wick. Under these conditions, however, it was not found possible to keep the oil consumption below 50 grammes per hour; and after communicating with M. Vautier (whose reply is given in the appendix), the lamp was used with the wick 8 mm. above the holder and the chimney 7 mm. above the wick—thus reducing the consumption to about 42 grammes per hour. Upwards of 100 independent observations have been made on it, and attempts made to bring the measurements more into line by using different chimneys and by taking the average of several readings in different directions round the lamp. But the observations which are plotted on fig. 3 point to the fact that the constancy of the lamp cannot be depended upon to within 3 per cent.; and attempts to deduce a correcting formula for variations in humidity and barometer would be quite useless. The individual observations are therefore merely plotted in fig. 3 to serve as a comparison with figs. 1 and 2. The results obtained from the

lamps individually are shown on the right-hand side; and by taking the mean of each of these sets of observations, the following values will result:—

Candle power (Carcel lamp 1 in pentane units) = 9·80
" (" 2 " ") = 9·85

which, taking the mean, gives the following ratio :—

$$\frac{\text{Pentane}}{\text{Carcel}} = \frac{10}{9{\cdot}825} = 1{\cdot}018$$

—viz., the Carcel being about 2 per cent. less than the 10-candle pentane lamp.

Notes on the Use of the Standard Lamps.

The Pentane Lamp.

The pentane lamp was set up and used in accordance with the instructions given in Appendix A of the Notification of the Metropolitan Gas Referees; the height of the flame being accurately adjusted in all measurements to a point half-way between the bottom of the mica window and the cross-bar. Adjustment was made by regulation of the air-inlet to the saturator. The pentane used was obtained in several different consignments from Mr. S. E. Miller, of Oxford, and conformed in all respects with the tests given in Appendix B of the Notification. The residues in the saturator were removed from time to time after the lamp had been in use about a fortnight. Both in the use of the pentane and Hefner lamps a second observer watched the flames of the lamp under test, and notified when it was burning at the correct height. For the purpose of reference, copies of the appendices mentioned accompany the report.

The Hefner Lamp.

The Hefner lamps used in the comparisons were those numbered 960-1902 by Siemens and Halske, and 1117-1904 by S. Elster; both having been certified at the Reichsanstalt in Berlin. The amyl-acetate used in the tests was obtained from the Chem. Tech. Prüs. and Versuchs-Anstalt, Karlsruhe—being certified by them for use with the Hefner lamp, and was found by us to pass the requisite tests for purity. The wick used was also supplied with the lamps, and fitted easily into the wick-tubes. The height of the flames was adjusted to 44 mm. with the optical device that is supplied for the purpose; the amyl-acetate being emptied out and changed from time to time during the tests. The instructions and precautions to be observed when using the lamp are given in the Zeitschrift für Instrumentenkund " for July, 1893, and were carefully attended to in all our experiments with it.

The Carcel Lamp.

For instructions and precautions to be observed in the use of the Carcel lamp, we are indebted to M. Vautier, of Lyons, who has kindly furnished us with details of the practice which is followed in the French gas-testing stations. The two lamps were used on one of the standard balances supplied for the purpose; their dimensions being found to agree with the measurements given in " L'instruction pratique donnant la marche à suivre pour les expériences relatives à la determination journaliére du pouvoir éclairant," a copy of which accompanies this report. The instructions given in the pamphlet were followed in the use of the lamp, with the exception that, in order to bring the consumption of the oil within the requisite limits, the wick was lowered to within 8 mm. of the wick-holder; the neck of the chimney remaining 7 mm. above the top of the wick. By this means, the oil consumption was kept to within 40 and 46 grammes per hour—the candle power at each observation plotted on fig. 3 having been previously corrected to that which would be equivalent to 42 grammes per hour. The wicks were kept in a desiccator until just before use, and a fresh wick was used for each experiment. The colza oil and wicks employed in the tests were obtained from France; being the same as those used in the Paris testing-stations. The instructions and recommendations for lighting the lamp, which have been kindly supplied to us by M. Vautier, are copied from his letter and given in the appendix at the end of this report. Precautions were taken, as far as possible, to prevent contact of air with the oil in the bottles in which it was stored. It was also changed in the lamps every two days, and the iodine number for the residues found to have remained the same as that of the fresh oil.

Comparison and Criticism of the Three Lamps as Standards of Light.

The comparisons which we have made between the three principal flame standards now in use have given us opportunities for comparing them under working conditions and judging of their relative suitability as standards of light.

As regards the Carcel lamp, we have not found that its constancy from day to day is comparable with that of either the Hefner or pentane lamps; its variations from the mean being as much as + or − 3 per cent., the reason for which we can only attribute to difficulty in reproducing the same conditions of capillarity in the wicks used. Though all possible care was taken in our measurements to produce the most favourable conditions of constancy, the results were not satisfactory; and in the notes which follow, the pentane and Hefner lamps only are considered with reference to their suitability as light standards.

General Construction.

The Hefner lamp, having only $\frac{1}{11}$th the candle power of the pentane, is much simpler in general construction, small, and more easily set up, and should be simpler to manufacture and adjust to standard dimensions.

Ease of Regulation and Working.

We have found in using the lamp that the flame of the 10-candle pentane standard is a great deal easier to adjust, and remains more constant while observations are being made, than that of the amyl-acetate lamp.

The fact that the Hefner unit has a lambent flame burning in free air, whereas the pentane standard is well shielded and, owing to its chimney, has a more stable flame. makes the latter practically independent of the draughts which would render measurements with the Hefner lamp quite impossible. Though the flame of the Hefner lamp was screened from draughts in our measurements, slight movements of the air cannot be avoided. These disturb the flame so that it only remains at its correct height for a few seconds together, rendering adjustment difficult and the taking of candle power readings rather a tiring process. On the other hand, it is not safe to assume that, owing to the cutting off of the top of the flame of the pentane lamp, the latter may be allowed to vary appreciably in height. Variations of 3 mm. up or down do not materially affect the candle power; but for accurate work a second observer is required to see that the top of the flame is flat, and regulate it to the correct height.

Reproducibility.

As far as accuracy in candle power is concerned in different lamps made to the same specification, we have only had the opportunity of examining the two Hefner lamps mentioned in this report, and the candle power of which we have found identical. The remarks made in the opening paragraphs show that, with pentane lamps manufactured with ordinary care, the largest variation in illuminating power which may be expected is $\frac{1}{2}$ per cent. Lamps which adhere rigidly to specification agree to a greater accuracy than this. We have used different samples of pentane which come within the limits of specific gravity prescribed, and have not noticed more than 0·4 per cent. difference in candle power due to this cause. The amyl-acetate used was all from the same consignment from Karlsruhe. As far, therefore, as our experiments show, we find little to choose between the two standards on the score of reliability of reproduction.

The Nature of the Light.

The pentane lamp has a whiter light than the Hefner unit; being much more nearly of the same tint as the Carcel standard. The fact that its candle power is eleven times that of the amyl-acetate lamp, makes it of the same order of candle power as the ordinary lights which are tested against it. These two factors, coupled with the greater ease of adjustment when making observations, have greatly outweighed, in our opinion, the disadvantage of more complicated construction, and led to the adoption of the 10-candle pentane lamp by us as the primary standard of light.

(Signed) R. T. Glazebrook, Director.

Appendix.

Translation of Extract from Letter by M. Vautier, giving Instructions and Precautions to be observed in the Use of the Carcel Lamp.

We have also observed that the Carcel lamp burns more oil than the quantity specified, when the height of the wick is 10 mm. To avoid this difficulty, we regulate the height of the wick to 7 or 8 mm.; and we put the chimney at about 7 mm. above the upper edge of the wick. Under these conditions, the Carcel lamp burns very approximately 42 grammes of oil. A slight variation in the height of the wick from the chimney, within the limits above specified, is sufficient to bring the consumption of oil to very nearly 42 grammes. We have noticed that the influence of a slight modification of the wick is about three times as great as the corresponding movement of the chimney. The following information may perhaps also be of interest to you.

The wick should be first cut clean and square with the wick-holder, and well saturated with oil. It is then raised to about 12 mm. above the wick-holder. It is well and uniformly lighted by means of a batswing gas-flame, with its flat surface held horizontally. When a charred ring of about 2 mm. in height has been obtained, the chimney is rapidly placed on its support, the wick is lowered to 7 or 8 mm., and the chimney is lowered to the same height as the wick, which makes the lamp burn with a depressed flame. The lamp is left burning in this manner for a few minutes. The flame ought to be quite regular; and the charred ring should also be of uniform height. The wick ought not to be charred over a height of more than 2 mm. from the application of the batswing gas-flame, otherwise it would not be possible to bring the consumption of oil to the amount of 42 grammes. After the lamp has burnt in this manner with the flame depressed some minutes, the chimney is raised to 7 mm. above the upper edge of the wick—the latter being left at the height of 7 to 8 mm. The flame increases in size, and the lamp is allowed to burn for about 20 minutes in order that it may take up its normal condition. During this time, the height of the wick and of the chimney may be slightly varied, in order to bring the consumption of oil as nearly as possible to 42 grammes.

STANDARD TEST BURNER FOR LONDON GAS.

By Charles Carpenter and James W. Helps.

[A Paper read by Mr. Helps before the International Committee on Photometry at Zurich last Saturday.]

When communicating to the first session of this congress a note upon "An Improved Photometer for Testing Incandescent Burners," the authors took occasion to express their satisfaction that the official mode of photometry prescribed in London had at last been based upon the method of Dumas and Regnault.

Since the year 1869, when Sugg's "London" argand was first prescribed by the Metropolitan Gas Referees as the standard burner to be used for testing the gas supplied to the Metropolis, it had been used with a fixed gas consumption of 5 cubic feet per hour. The unscientific method of so using it was well known by all experimentalists; but it was not until the year 1900 that the South Metropolitan Gas Company were able to persuade the Legislature to adopt the more rational Parisian method devised by the eminent French savants in 1861. The victory of reason over prejudice was not long unchallenged.

The control of the gas supply to London is in the hands of three bodies: First, the Legislature, which enacts what shall be the quality, and lays down the principles to be observed in testing it; second, the Metropolitan Gas Referees, who prescribe the apparatus to be used for this purpose; and, third, the London County Council, who are the authority for carrying out the testings. The officials of the last-named body regarded with dissatisfaction the adoption by the Legislature in 1900 of the Parisian method of using the standard burner; and, owing to their representations, a Committee of the Board of Trade (presided over by Lord Rayleigh) was appointed to consider *inter alia* whether this method or a 5 cubic feet fixed rate of gas consumption should be adopted. The Committee recommended the latter course; and the London County Council forthwith presented a Bill to Parliament to legalize that mode of testing.

The measure passed the House of Commons; but the House of Lords, to whom in turn the Bill was submitted, made an important modification in the original proposal. They accepted the principle of consuming the gas at the fixed rate of 5 cubic feet per hour, but stipulated that the burner and its use were to be such as to obtain from the gas the greatest amount of light. As a result of this decision, experiments were made by the South Metropolitan Gas Company in order to produce a burner which would comply with these conditions. The tri-current argand burner was already used in some English towns as a standard; and with it investigations were carried out based upon measurements of the air currents flowing to its flame through each of the three channels provided in its design. The apparatus used for this purpose is shown in figs. 1, 5, and 7,* and was arranged as follows: The burner was fixed at the head of a conical chamber divided into three concentric compartments having at the base of each a perforated baffle with a "hit-and-miss," by which the flow of air could be regulated with exactitude. Air from a balanced holder was passed through three suitable meters, and the quantity required to obtain the best result from the gas under test, when consumed at the rate of 5 cubic feet, was ascertained by a process of trial and rejection. The correct dimensions were finally obtained, from which a burner was constructed in which might be produced the same results with a natural but regulated draught. This burner has been named "The 'Metropolitan' Argand Burner No. 2."

In Table A are given the results of some experiments which will show to what extent it reaches the best possible results with various qualities of gas. Tables B and C give a calculation of the theoretical amount of oxygen required to effect the complete combustion of two different samples of gas. Attention may be directed to the differences between the first and second columns in Table A. From these it will be seen that a better duty of of about half-a-candle appears to be possible. This is indeed the case; but it is wholly a matter of the regulation of the outer or chimney current of air.

The burner as at present constructed will burn gases of very wide range—up to near about 20 candles. The object sought in determining its construction was to ensure its acceptance by the three London Gas Companies, though the gas they supply differs in quality and composition; and to achieve this result some of its efficiency was sacrificed with certain qualities. A burner constructed in accordance with fig. 2 would have obviated this difficulty; but its use would have been less simple. Another burner has been made to attain this end in another way, though it is more complex and costly to construct. It is shown in fig. 4, and is so constructed that when the flow of gas to the inner and outer edges of the flame is regulated, a portion of the chimney supply is also adjusted.

The "Metropolitan" argand burner described by the authors has been adopted by the Legislature as the standard in many towns of Great Britain, as well as in London. Its use is free from some of the objections raised to the Parisian method when the gas to be examined contains considerable quantities of carburetted water gas, which burns with a much shorter flame in the argand burner than unmixed coal gas, and is therefore over-aërated.

The time does not appear to be ripe in England for the abolition of official testings for illuminating power, despite the rapid increase in the use of Auer burners. The authors venture to express the hope that this fact may be accepted as an apology for introducing to the notice of the International Committee on Photometry a subject which day by day becomes rather of academic interest than of practical value.

Table A.—*Experiments with No. 2 Metropolitan Argand Burner, arranged to be Supplied with Three Measured Streams of Air.*

Illuminating Power in Candles; Gas Consumption 5 Cubic Feet per Hour.		Air Required in Cubic Feet per Hour.			
Air Adjusted by Damper.	Each Air Supply Regulated to Give Best Results.	Inner Surface of Flame.	Outer Surface of Flame.	Chimney.	Total.
13·1	13·2	5·89	6·53	11·68	24·10
13·5	14·0	6·97	6·32	10·08	23·37
15·1	15·4	7·13	6·41	11·07	24·61
15·2	15·6	7·07	5·23	12·29	24 59
16·2	16·6	9·16	7·35	10·58	27·09
17·0	17·6	8·89	6·98	12·84	28·71

Table B.—*Calculated Volume of Air Required for the Combustion of One Volume of Coal Gas having an Illuminating Power of 15·6 Candles at 5 Cubic Feet Rate, with No. 2 Metropolitan Burner.*

	Composition. Per Cent.		Theoretical Quantity of Oxygen Required. Vols.
Hydrogen	48·18	..	24·09
Saturated hydrocarbons	34·18	..	68 38
Unsaturated hydrocarbons	3·05	..	9 15
Carbon dioxide	0·82	..	Nil
Carbon monoxide	4·76	..	2·38
Oxygen	0·61	..	0·61 (deduct)
Nitrogen	8·45	..	Nil
	100·05		103·37

$\frac{1·0337 \times 100}{20·54}$ = volumes of air required for the complete combustion of one volume of gas, or 25·15 volumes per 5 cubic feet of gas.

Table C.—*Calculated Volume of Air Required for the Combustion of One Volume of Coal Gas having an Illuminating Power of 17 Candles at 5 Cubic Feet Rate, with No. 2 Metropolitan Burner.*

	Composition. Per Cent.		Theoretical Quantity of Oxygen Required. Vols.
Hydrogen	47·88	..	23·94
Saturated hydrocarbons	32·62	..	65·24
Unsaturated hydrocarbons	3·45	..	10·35
Benzine vapour	1·27	..	9·53
Carbon dioxide	1·53	..	Nil
Carbon monoxide	6·14	..	3·07
Oxygen	0·20	..	0·20 (deduct)
Nitrogen	6·91	..	Nil
	100·00	..	111·93

$\frac{1·1193 \times 100}{20·54}$ = volumes of air required for the complete combustion of one volume of gas, or 27·25 volumes per 5 cubic feet of gas.

* It is unnecessary to reproduce the illustrations, as they are the same as those which were given in the "Journal" in connection with the paper which Mr. Carpenter read before the Institution of Gas Engineers last year—see Vol. XCIV., pp. 887-8.

METHODS FOR MEASURING THE LIGHT OF INCANDESCENT BURNERS IN HOLLAND.

By Heer Van Rossum du Chattel.

[A Paper, read by M. Vautier, before the International Photometric Committee last Thursday.]

The author regretted that his efforts to collect the rules generally followed in Holland for determining the illuminating power of incandescent burners had been almost fruitless. From the few particulars available, he was able to report that generally the German method was followed in Holland—viz., the prescriptions made by the Photometric Committee of the German Association of Gas and Water Engineers in 1904. Nevertheless, there were just a few differences, of little real importance, which might be pointed out.

As a standard of light, the Harcourt pentane lamp was used at Amsterdam. The Hefner lamp was never employed directly in the photometry of incandescent burners. It was only used to determine the illuminating power of a gas-light standard of 15 to 20 candle power, of which the illuminating power was kept constant by supplying the gas standard throughout the test with gas of constant composition from a holder. The holder was provided with a rotatory blade agitator, which insured uniformity of composition of the gas. The Amsterdam works possess a great number of photometers, comprising four with the Dutch etherbenzene standard, five Letheby photometers with various Methven standards, five Flicker photometers, and two Harcourt pentane

lamps and two Hefner lamps. Consequently they are in a position to make a great number of tests of incandescent burners.

The illuminating power of a mixture of coal gas and water gas is determined by burning it in the English standard burner, as certified by the Board of Trade. The quantity of air admitted is exactly regulated by the damper, which turns on a very fine screw thread. This burner has been adopted by the Dutch Photometric Committee. These burners are made exactly to dimensions, and so that they may be turned about their vertical axes to any point on a disc graduated in degrees. The new photometers used are made by Messrs. Simmance and Abady, with a distance of 2 metres between the sources of light. They are graduated round iron bars, on which are mounted the Flicker apparatus, either for horizontal or angular readings as may be required. For the photometry of high-power or high-pressure incandescent gas-burners, intermediate incandescent mantle standards, of which the illuminating power has been determined with great precision, are used for the direct comparisons. Care is taken to light the burners sufficiently long before making a test, and generally the conditions set out in the German testing prescription (*vide supra*) are observed in the minutest particular, and mantles of faulty shape are rejected.

The Amsterdam works are in a favourable position in that they impregnate, fix, and collodionize their own mantles, using foundations obtained from different countries. They employ a dozen women on this work, and turn out somewhere about 1000 mantles a day. The "Auer No. 1" burner, with regulator for the air supply, is employed for the mantle tests. The gas used is of constant composition, and of which the illuminating power has been previously determined by means of the Harcourt standard; and the burner is regulated until the maximum illuminating power is being developed by the mantle. The mantle is kept in incandescence for 1000 hours, and tests are made at the start and at 50, 100, 300, and 1000 hours. The capacity of the gasholder in not sufficiently great to admit of the whole of the tests on one mantle being made with one charge of gas; it is re-filled, and the new charge brought to the same illuminating power by carburetting with benzol. The burners tested at Amsterdam included the Somzée-Greyson, the Sugg, Keith, Kern, Millennium, and Goldberg's modification of the burner of Messrs. Schülke, Brandholt, and Co. These burners were of very different sizes up to illuminating powers of upwards of 2000 candles.

At the Rotterdam Gas-Works, Dr. Leonard Weber's photometer is in use. With this, the distance from the axis of the mantle to the (No. 3) opal glass screen is one metre. The light used as the standard in the tests is a benzoline flame, 2 centimetres in height. The illuminating power of this flame and the constant for opal glass were determined twenty or thirty times at different distances, by reference to the Hefner lamp. In this manner of working, no trouble was found from differences of colour.

The method of using red and green glass has only been employed for the sake of comparison, and generally gives rather high results. An ordinary Welsbach burner, of which the air supply can be regulated, is used in the tests. The mantle burner is supplied with coal gas exclusively, and is arranged so that it is giving the maximum illuminating effect under a constant pressure of 40 mm. The quantity of gas burnt is varied considerably—viz., from 90 to 150 litres (3·18 to 5·30 cubic feet) per hour. The Hefners are afterwards reduced to English sperm candle values; and correction is made for variations of temperature and pressure. The chimney used is 25 cm. (9·8 inches) long, and 4·5 cm. (1¾ inches) in internal diameter, as is generally used by consumers. Three observations are made in series; the mantles being turned round one-third of a circle between each.

North British Association of Gas Managers.—The forty-sixth annual general meeting of the Association will be held in the Philosophical Society's Hall, Bath Street, Glasgow, next Thursday, under the presidency of Mr. Lawrence Hislop, of Uddingston. We learn from the programme issued by the Secretary (Mr. R. S. Carlow, of Perth) that, in addition to the Inaugural Address, there will be three papers. Mr. Alex. Yuill, of Dundee, will contribute some notes on the "Practical Working of Gas-Works;" Mr. J. D. Smith, of Stirling, will deal with the subject of "Naphthalene Extraction;" and Mr. James Campbell, of Polmont, will take up the question of "Introducing a Supply of Gas into a New District." In the evening the members will dine together in the Grand Hotel; and next day they will have an excursion to Campbeltown, *viâ* Wemyss Bay.

The Retirement of Professor Lunge.—In connection with the retirement of Professor G. Lunge from the Chair of Technical Chemistry at Zurich, to which reference was made in the "JOURNAL" last week, we learn from "Nature" that an interesting farewell meeting was held on the 10th inst., at the Zurich Polytechnic. The occasion was the distinguished Chemist's last lecture hour, and, in addition to the students, most of his fellow professors and some from the neighbouring University had assembled. On Professor Lunge's entry into his lecture theatre all rose in silence. After a brief interval, Professor Treadwell, Professor of Analytical Chemistry, made a short speech in which he eulogized Professor Lunge's work, and afterwards read an address from the whole of the teaching staff. An address from the students was also read. Professor Lunge made a suitable reply; and the audience showed by its enthusiasm the high regard in which he is held and the regret felt at his retirement.

SULPHATE OF AMMONIA AS A MANURE.

In another part of the "JOURNAL" will be found the report of the Sulphate of Ammonia Committee. In the course of a report by Mr. John Hunter, F.I.C., F.C.S., the Technical Adviser to the Committee, on experiments that have recently been carried out by him, further evidence is afforded of the value of sulphate of ammonia in agriculture.

Mr. Hunter states that from every experimental station at home and abroad (with one notable exception) there had come a repetition of field and plot results which all go to prove that organic nitrogeu from Peruvian guano or sulphate of ammonia is invariably superior to inorganic nitrogen in nitrate of soda, nitrate of lime, or nitrate of potash; and that where these sources of organic nitrogen have been tested against each other, sulphate of ammouia has proved itself the most reliable and the most economical. The "notable exception" referred to is an English Agricultural College where nitrate of soda is practically the only purely nitrogenous manure employed; but Mr. Hunter says this limited line of investigation (fortunately for agriculture) does not appear to recommend itself to other experimentalists.

The Agricultural Executive Committee of the Lancashire County Council report the best results in the potato trials from 10 tons of farmyard manure, 4 cwt. of superphosphate, 1½ cwt. of sulphate of potash, and a like weight of sulphate of ammonia per acre. The Irish Department of Agriculture, as the result of experimeuts in County Carlow, again recommend superphosphate, sulphate of ammonia, and potash salts. The Board of Agriculture (London) recommend the following as the best potato manure: 10 tons of farmyard manure, 2 cwt. of superphosphate, and 1 cwt. each of sulphate of potash and sulphate of ammonia per acre; and that where farmyard manure is not available, the best mixture to use is 4 cwt. of superphosphate, 2 cwt. of sulphate of potash, and 2 cwt. of sulphate of ammonia. Similar recommendations are made by the Cambridge University experts and by the Agricultural Research Association; and they are corroborated by reports from all quarters.

Concerning the feeding experiments, Mr. Hunter says it is again proved beyond all doubt that crops grown by organic nitrogen (by ammonia salts) possess the best feeding properties, as illustrated by the prize winners at the Smithfield and Scottish National Shows; and the Committee's own experiments, conducted in nearly every district in England, Scotland, and Ireland, again provide interestingly valuable evidence as to the importance of organic nitrogen, in the numerous examples of applying a general mixture. But where comparing-plots without sulphate of ammonia have been grown alongside, its great value is made manifest by the handsome increase of crops obtained by including sulphate of ammonia in the mixture.

The experiments on yellow turnips are confined to Scotland; but the smallest crop is more than 31 tons per acre, while the majority of the crops are conspicuously higher, and reached the magnificent return of nearly 52 tons per acre. The greater number of the crops in the swedes class range from 30 to more than 48 tons per acre; but even in the case of the smallest crops, the profitableness of iucluding sulphate of ammonia in turnip manures is put beyond all doubt. With the exception of one small crop of mangels in the Thame district, the crops range from upwards of 30 tous up to nearly 69½ tons per acre; while the majority are over 50 tons. The largest crop—69 tons 7 cwt.—was grown with a good general manure containing 2½ cwt. of sulphate of ammonia. Ou the adjoining plot, where sulphate was excluded, but the manuring was the same in every other respect, the return fell to 51 tons 12 cwt.—a difference of nearly 18 tons per acre. Mr. Hunter states that in all the other similar examples in this class, the addition of organic nitrogen in the form of sulphate of ammonia has proved highly profitable and confirms most absolutely the many earlier records of the marked advantage of sulphate in mangel culture.

The smallest crop in potatoes is 12 tons 1 qr. per acre. There are seven crops of about 13 tons per acre; but all the others are from 14 tons up to 18 tons 3 cwt. In this class also the advantage of sulphate is very conspicuous; and Mr. Hunter says it is now a well-ascertained fact that nitrates invariably give rise to waxy tubers whose value is, of course, much less than that of "good cookers."

The range of crop in the class of field cabbage is from 64 tons 1 cwt. to 74 tons 16 cwt. 2 qrs. 12 lbs. per acre. Mr. Hunter regards it as surprising that farmers do not grow more cabbage, as on suitable soil a very large weight per acre can be produced. Weight for weight, cabbage is a distinctly richer food than turnips; it forms an excellent change of food and well repays the trouble of planting. Withholding sulphate of ammonia from the manure mixture caused a drop of from 10 tons to nearly 12 tons per acre in the yield.

Mr. Hunter says that it is a remarkable feature that in all the foregoing classes where ground lime has beeu used, the limed crop is almost invariably the best in every district. This is a question of the utmost importance to every agriculturist; and as the rational application of lime to soils has been very fully explained in the Committee's pamphlets (which farmers can procure free of cost), he considers they will be blind to their own interests if they do not forthwith make full inquiry as to the advantages to be gained by this method of treating soils.

THE ASSOCIATION OF WATER ENGINEERS.

ANNUAL MEETING AT WINDSOR—JUNE, 1907.

PAPERS READ.

(3)

NEW WATER-WORKS AT MILTON-NEXT-SITTINGBOURNE.

A paper on the above subject was submitted by Messrs. William Gore and Martin Deacon, Assoc.MM.Inst.C.E., from which the following are extracts.

Milton-next-Sittingbourne, or Milton-Royal as it will probably be known in the near future, is situated in the northern portion of the County of Kent, on the south bank of the River Swale, and about 10 miles in an easterly direction from the town of Chatham. Prior to the year 1904, the urban district of Milton obtained its water supply from the works of the neighbouring urban district of Sittingbourne, in return for which Milton contributed a portion of the capital, establishment, maintenance, and other charges. The population of Milton at the census of 1891 was 5213, and in the spring of 1901 it was 7091—showing an increase of 1878 in ten years. The Sittingbourne works having proved inadequate to meet the increasing demands of Milton, Mr. G. F. Deacon, in August, 1901, furnished a report to the Milton Urban District Council, recommending the scheme described in the present paper. It was accordingly decided to apply to the Local Government Board for a loan. In September, 1902, the necessary approval was obtained; and the following works were subsequently carried out.

Pumping Station.—The pumping station is situated upon a triangular piece of ground at the junction of two roads, and the buildings stretch across the bottom of the valley at the base of the triangle facing the apex; the site being surrounded by hop and fruit gardens. The buildings comprise an engine-house, with two well-houses equally spaced on either side, and an attendant's house, which is partly behind and partly to one side of the engine-house, of which it is an extension. Transmission shafts, by which the engines drive the pumps, are placed in culverts above the original ground level, but below terraces (faced with low retaining walls) which link the buildings together. Access to the terraces is obtained by stone steps on either side of the engine-house. The buildings are of red brick, with Bath stone facings except the lower parts, which, with the terrace walls, are faced on the outside with Kentish rag. The roofs are covered with red tiles. Ornamental entrance gates have been provided, and the grounds have been suitably laid out and planted with shrubs.

Wells and Adits.—Two wells, at a distance apart of 100 feet, were sunk to a depth of 109 feet. The upper 12 feet in each well is 6 feet in diameter, and the remaining 103 feet is 5 feet in diameter. They are lined with brickwork in cement mortar to a depth of 40 feet. The lining at the top of each well is hollowed out to provide room for an air vessel, and extended to carry the overhead gearing and the protective building. For 6 feet, the wells pass through surface soil and gravel; for the remaining depth, through upper chalk with flints. In the western well a borehole 9 inches diameter is sunk to a further depth of 60 feet, wholly in the upper chalk with flints. An adit 5 feet high and 4 feet wide was driven between the two wells, with its invert at 103 feet below the surface in the western well and rising to 101 feet at the eastern well, whence an additional adit is driven at first eastward and then south-eastwards, making a total length of adit of 165 feet.

The sinking of the wells was carried out by hand as follows: Both wells were sunk till water was reached, which was at 61·5 feet from the surface in the western well and 65·5 feet in the eastern well; and as the surface level was the same (135 O.D.) at both wells, there was a difference in the levels of the water of 4 feet—a remarkable circumstance for two wells only 100 feet apart.

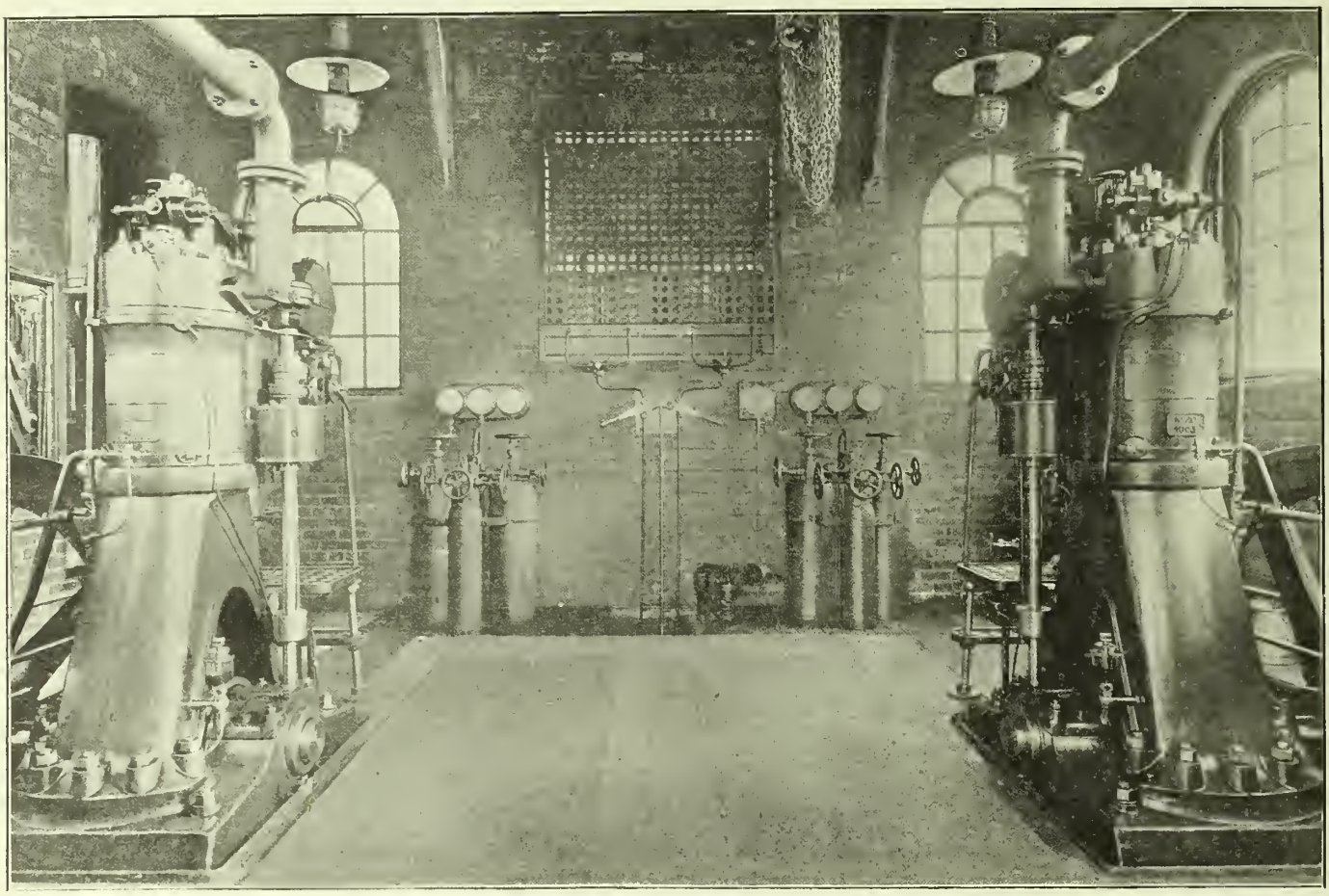
Temporary pumps were next erected in the western well, which was then sunk to a depth of 104 feet, or 1 foot below the level of the adit. The continuous yield of this well amounted to 8000 gallons per hour. The 9-inch borehole was then sunk, and the yield increased to 10,000 gallons per hour. The adit was next driven from the western well towards and under the eastern well, and the yield rose to 18,000 gallons per hour. While this quantity was being pumped out, the level of water in the partially completed eastern well remained practically unaltered, notwithstanding that the adit was driven underneath it. To drain this well a 9-inch borehole was driven down to the adit, and then the well was sunk to a depth of 109 feet; the yield being increased to about 20,000 gallons per hour.

The eastern adit was then driven for about 10 feet, and the yield rose to 21,400 gallons per hour. As the temporary pumps could only with great difficulty keep the water down, the Contractors, with the Engineer's permission, decided to instal the permanent pumps, although the western well had yet to be sunk 5 feet deeper and the adit to be extended further. The work of sinking the remaining 5 feet of the western well was subsequently carried out by divers; and during the completion of the eastern adit the permanent pumps were used—precautions being taken to allow the turbidity of the water to subside before it reached the pumps. The yield of the well had now increased to 24,000 gallons per hour.

At the present time one set of engines and pumps, pumping at the rate of about 16,000 gallons per hour for eight hours, lowers the water from 64 to 84 feet below the surface. The water returns to its original level in the course of a few hours after pumping has ceased. The storage capacity of the wells, adits, and surrounding chalk admits of both sets of engines and pumps being run continuously for about 5 hours before the water is drawn down to the suction openings in the pumps.

Pumps.—Each set of pumps consists of three single-acting "Ashley" pumps, 6½ inches in diameter, with a stroke of 30 inches, and is driven by three-throw cranks forged from one piece, which rotate at 27 revolutions per minute. Each working barrel is attached near the bottom of the well to an independent rising main, 8 inches in diameter, suspended from girders fixed near the surface. The rising main forms a guide to the pump-rods, which are 91 ft. 6 in. long. A short distance above the suspension girders is the stuffing-box, cast in one piece, with the crosshead guides and cover to the working barrel. The bucket of each pump consists of a gun-metal sleeve, 4 feet 10 inches long, which fits the working barrel for a distance of 7½ inches at each end. The central portion of this barrel for a length of 3 feet 7 inches is reduced in diameter and flattened, in horizontal section to an equilateral triangle, to the three vertical planes of which the eighteen suction valves are screwed. The upper end of the sleeve carries the two annular gun-metal delivery valves, which are guided by the pump-rod. The suction valves consist of rubber discs, held by phosphor-bronze springs to gun-metal seats, the rubber discs being guided by stalks fixed to bridges across the suction openings. The centre of the working barrel is pierced with a number of vertical slots, through which the water can pass to the suction valves, and the bottom of the barrel is closed with a screwed plug. Each three-throw crank is driven by double helical gearing of cast steel, with a gear ratio of 8·65 to 1; the pinion being fixed at one end of the transmission shaft from its engine.

Engines.—The engines (see next page) were supplied by the Diesel Engine Company, and are single cylinder vertical internal combustion engines of 20 B.H.P. The diameter of the piston is 9½ inches and the length of stroke 15 inches. The cycle of operations in the engine cylinder is completed in four strokes. The oil fuel, which is desulphurized Texas liquid fuel with a calorific value of about 18,000 B.Th.U., is supplied by a small plunger pump driven by an eccentric upon a vertical shaft which carries the governors, and the amount of oil supplied is regulated by the governor controlling a device, which, by a movable eccentric, lifts the suction valve of the oil-pump for a shorter or longer portion of the delivery stroke, and thereby maintains a uniform speed. The oil is delivered at the pumping-station in 50-gallon steel barrels, and is there discharged into an underground tank which contains 700 gallons. From this tank the oil is pumped by hand into a high-level tank containing 100 gallons, which, together with four oil-filters beneath, is placed in an opening in the engine-house wall. The filtering



Engines at the Milton-next-Sittingbourne Water-Works.

material is a pad of felt ¼ inch thick placed between copper wire gauze. Each engine is provided with a silencer in the form of a cast-iron drum which is placed in a properly ventilated space in the entablature over the front door of the engine house.

Starting the Engines.—The engines (working as compressed air engines) although normally not required to do so, will, with the ease of steam-engines, start the pumps against the full head of the reservoir. An automatic device has been provided for stopping the engines when the reservoir is full; and it does its work very efficiently. A direct-acting balanced float regulator is fixed in the reservoir at the head of the delivery main. The float is placed in a separate cast-iron chamber which has only a small opening into the reservoir to ensure perfectly steady motion of the float. When pumping is in progress, and the water in the reservoir has run to within an inch of its top-water level, the regulator commences to close, and gradually increases the pressure in the delivery main until the relief-valve in the pumping-station opens automatically. Underneath the discharge-pipe of the relief-valve a copper bucket is suspended at the opposite end of a counterbalanced lever. When the bucket fills, it raises the counterbalance, and in so doing closes the oil-cocks upon the pipes supplying fuel to the engines, which stop in about one minute. The water in the bucket then runs out at a small hole, and the bucket returns to its original position for the next automatic stop. The float regulator is set with a minimum opening sufficient to create a maximum back-pressure of about 50 feet in the rising main when both engines are running, if the bucket is forcibly prevented from falling, This apparatus prevents the water from being run to waste at the reservoir unknown to the attendant, and allows him to be absent from the pumping-station for short intervals. The present practice is to run a set of engines and pumps every day until it stops automatically; one set being used one day, the other the next.

Service Reservoir.—The service reservoir at Stocker's Hill is circular in plan and 79 feet in diameter. It is 18 feet deep, and, when full to within 18 inches of the top of the coping, contains 550,000 gallons. Its top-water level is 208·75 feet O.D., or 177 feet above the suction openings of the pumps, and 184 feet above the general level of the ground at the point of supply about two miles distant. The reservoir is partly excavated and partly embanked in a homogeneous loam resting upon chalk. The floor is of 5 to 1 concrete 15 inches thick. It is divided into nine sections, which are separated from each other and from the wall by tapered grooves, 6 inches deep, filled in with asphalte. Large areas of concrete subject to variations of temperature inevitably crack; and the object of the grooves is to induce the cracking to take place along them and thereby relieve the tendency to crack at other places. The asphalte in the grooves acts as a viscous fluid under the pressure of the water, and seals any crack that may occur.

The walls are in the form of a vertical cylinder of 5 to 1 concrete 3 feet thick, faced with brindled brickwork, and surmounted with a concrete coping; the latter being moulded *in situ* in lengths of about 6 feet, separated from each other by thin strips of wood, which were afterwards cut out and the space caulked with cement mortar. A circular reservoir is much more economically constructed than one with straight sides, as the walls are less both in their length and thickness.

The experiment was first made of leaving the reservoir open to the air; but after being in use during the first summer months the usual green confervoid growth resulting from the open storage of most chalk waters appeared, and it was decided to cover it. The covering consists of arcades of concrete segments or tiles, 2 inches thick, 30 inches long, and 30 inches wide, struck to a radius of 50 inches, which rest upon the lower flanges of steel joists, $4\frac{3}{4}$ in. by $1\frac{3}{4}$ in., carried by main joists, 12 in. by 6 in., resting upon ten cast-iron columns and upon recesses in the circular coping of the reservoir. With the exception of the ends of the main joists upon the cast-iron columns and some special work at the valve platform, no fastening designed to act in tension was used in the construction of the framework.

The concrete segments were moulded on edge in collapsible boxes. Each box contained 10 segments separated from each other by greased sheet-iron partitions. The segments, protected by wet bags, were allowed to set for about three days. The boxes were then carefully taken apart, the sheet-iron partitions were withdrawn, and the concrete was allowed to harden for a month, or until such time as the segments were required. The proportions of the concrete were 5 to 1, and the limit to the size of the gravel used was ½ inch. After the segments had been placed in position, the irregular spaces between them and the circular wall were filled with concrete, and the joints between consecutive segments and at the ironwork were caulked with cement mortar.

Except for a short period when preparing the bases, and

during the erection of the cast-iron columns, the work of putting on the cover was carried on while the reservoir was in use for the supply of water to Milton. As a permanent work, such a covering is not, of course, so satisfactory as a groined roof—covered with earth and grassed over—supported by brickwork or concrete piers; but it is quite effective, and the more permanent work could not have been adopted without throwing the reservoir out of use.

Cost of Works.—The total cost of the works was about £13,400.

Cost of Pumping.—The price of the crude Texas oil is 50s. per ton at the Company's depôt, Thames Haven. The total amount paid for crude Texas oil last year was £32, for paraffin £12 15s., and for lubricating and other oils £9 10s.—making a total of £54 5s. The total cost of lifting the water 164 feet (including friction) into the reservoirs, including oils, tradesmen's bills, and wages at the pumping-station, works out at 0·79d. per 1000 gallons, equivalent to 4·8d. per million gallons raised one foot high, of which the labour represents 3·1d. For a scheme with engines of only 20 B.H.P., this is a remarkably high duty, and fully establishes the high economy claimed for the Diesel oil-engine. Some 48 million gallons of water were pumped from the wells last year in 3000 hours, or at an average of 8 hrs. 13 min. per day, to supply an estimated population of 8000, which, including trade supplies, amounts to 16½ gallons per head per day.

Discussion.

The President (Mr. C. Sainty) said they had to thank Messrs. Gore and Deacon for their paper. The Diesel oil-engine, so far as he could see, was an economical one; and it was a cheap way of getting water.

Mr. J. H. Secker (Slough), invited by the President to speak, said that at the Slough Water-Works he had a small Diesel engine of 10-horse power, with three-throw pumps, pumping 5400 gallons an hour, against 150 feet. The plant was not used every day, as it was for an extension made for the Slough Water-Works about three years ago for a high-level district, where they pumped from the main reservoir at Stoke up to Stoke Common, which was 150 feet high. With regard to the economy of the engine, he agreed with Mr. Sainty that it was an economical engine. His fuel consumption at the present time, pumping 5400 gallons an hour, was 0·34 of a gallon of paraffin, the cost of which in his case worked out at 6½d. per gallon. At the present time he was experimenting with a bye-product, which he was obtaining from the Diesel Engine Company; and this worked out to 3½d. So that this would practically reduce his money expense to one-half.

Mr. R. Askwith (Weardale Water-Works Company, Bishop Auckland) asked whether in connection with this engine there had been any liability to pre-ignition. Pre-ignition in an internal combustion engine was a serious matter, because the blow came upon the crank before the crank was in a proper position to receive it. He was informed that pre-ignition was overcome in gas-engines by squirting water into the cylinder. He should like to know whether it was possible to do the same thing in an oil-engine.

Mr. James Dewhirst (Chelmsford) remarked that he had not a Diesel oil-engine in use; but he had several of the ordinary type of oil-engines, varying from 5 up to 25 horse power. On one of them he had tried a crude oil for feeding the engine for power purposes, and a refined product for heating the lamps for ignition. The experiment was not to his mind satisfactory, because the crude oil contained some impurities, necessitating frequent cleaning of the vaporizer, combustion chamber, &c. He had recently put down a gas-engine of 20 B.H.P., with suction-gas plant, which was working very well indeed. It had, however, only recently been set to work; and he had not yet been able to carry out a series of tests as to fuel consumption and cost of pumping. But compared with an oil-engine of similar power, and doing very similar work at another pumping-station, the cost of fuel for the last three months was, for the gas plant, nearly one-half the cost of fuel for the oil-engine. His own experience with oil-engines was such that he should hesitate to use a Diesel oil-engine. He could purchase petroleum at prices varying from as low as 3¼d. per gallon to 6d., but the costs worked out very low. Regarding the paper, he thought if the authors had a breakdown with the left-hand engine and the right-hand pump or *vice versâ*, they would be in an awkward position. In his own case he could run either pump or engine in any way he liked.

Mr. N. M'K. Barron (Lincoln) remarked that the authors stated that the reservoir was partly excavated and partly embanked in a homogeneous loam resting upon chalk. He should like to know the respective depths of the loam and the chalk, and the angle of repose of the excavated material. Further, it would be interesting to learn the thickness of the brickwork facing. Also whether the concrete floor had been rendered. If not, had the reservoir proved water-tight?

Mr. J. S. Pickering (Cheltenham) asked why two wells were sunk, instead of one, as the same quantity of water could have been obtained from one well; and there was a certain loss of power transmitting this through shafting.

Mr. William Matthews (Southampton) said he was going to ask the same question, as to why the authors adopted two wells necessitating the use of long transmission shafting. Then a question arose out of the statement of the authors that precautions were taken to allow the turbidity of the water to subside before it reached the pumps. He (Mr. Matthews) should very much like to know how this was done. With regard to the machinery, he could not say he was much taken with the arrangement of putting three long suction barrels down in the way described, and, every time there was anything to be done, having to pull everything up, including all the long rods, and dispose of them at the top of the well. Three sets to one pumping plant of this rather limited capacity! It was surely adopting an arrangement which was giving a great deal of trouble in working. He should also like to know whether the floating automatic arrangement for stopping and starting the engine was satisfactory, and whether the starting of the engine by compressed air acted well in practice. The question of pre-ignition was an interesting one to him, because he had recently been looking at a pumping set and an engine of the Hornsby type, in which the conditions internally appeared to be so unsatisfactory that the engine could only be run for about five hours without having to remove the cover and clear out the vaporizer. This was not a condition of things that he should consider a very happy one. With regard to the covering of the reservoir, why was the plan described adopted, instead of using concrete, allowing it to set *in situ* upon framing or centering, as was frequently done. The total cost of pumping given at the end of the paper was certainly one upon which those responsible for the design of the works had every reason to congratulate themselves. It was really very low.

The President remarked that when he saw these pumping costs, he also thought the authors were to be highly complimented.

Mr. Gore, in replying to the discussion, said the figures given of the cost of pumping were the actual working costs as abstracted from the books last year, supplied to him by the Surveyor of Milton, who had charge of the works. The paraffin oil included that necessary for illumination, heating, and general purposes at the pumping-station. He had not heard of pre-ignition in connection with this particular plant, nor, in fact, in any other Diesel engine plant. In reply to Mr. Dewhirst's question as to the left-hand engine and the right-hand pump breaking down simultaneously, there were three pumps in each well; and the risk of all three breaking down simultaneously was very remote. If one broke down the other two could be worked without it. They had six times the necessary power at the present time, and that was a very good safeguard against breakdown. The two wells enabled two independent sets of pumps to be put in, so that work could be carried on in one well without interfering with the pumping at the other. The rods and the pump buckets had been lifted once since the plant was started. This was done quite easily without pumping. There was something like 50 feet of water in the well, which could not be lowered to get at the pumps in the ordinary way. With the rising main in the wells suspended at an easily accessible place, it and the pumps and their valves could be easily drawn to the surface. The thickness of the brickwork of the reservoir was 9 inches for three courses out of every four; and the fourth course was 13½ inches. At the back of the brickwork was a ring of mortar ½ inch thick. The reservoir was sunk about 11 feet in the ground and embanked the remaining 8 ft. 3 in. He believed the natural angle of repose of the excavated material was considerably over 50°. With regard to the float regulator in the reservoir for stopping the engines, it worked perfectly. The attendant filled the reservoir every day. He simply started the engines, and let them run until they were stopped by the automatic appliances; and there had been no trouble since it had

been put into working order. One of the reasons, as stated in the paper, for adopting the particular type of covering for the reservoir was to keep it in use for the supply of the town during construction. If ordinary concrete had been put in, it would have been much thicker than the present 2 inches, requiring a heavier and more expensive steel framework to support it. The reservoir was found by careful gaugings to be absolutely water-tight. The turbidity of the water during the driving of the eastern adit was removed by collecting the springs and passing the water direct to the pumps and by settling the remainder. Most of the pumping was carried on at the well farthest from the position at which the adit was driven. The difference in level at the end was 3 ft. 6 in., and successive tanks were put in so that the turbid water escaped first from one to the next, and there was considerable settling capacity for the small amount of turbid water.

Mr. MATTHEWS: Then you had a good big fall.

Mr. GORE: Yes. There was 2 feet in the main adit; and in the adit being driven, it was 1 ft. 6 in.

(4)

SCUNTHORPE WATER-WORKS.

The last paper was a description of the Scunthorpe Water-Works; the author being Mr. Alexander M. Cobban, the Water Engineer of the Urban District Council.

Owing to the development of the large deposits of iron ore upon which the township of Scunthorpe is situated, and the establishment of several iron-works, as well as the large steel-works of the Frodingham Iron and Steel Company, Limited, the township has grown from a village to the position of the second most important township in North Lincolnshire. In 1871 the population was 616, whereas the population of Scunthorpe, without the neighbouring townships of Crosby, Frodingham, and Ashby, now exceeds 9000, and the number of houses has increased from 877 in 1895 to 1600 in 1905. The area of the Urban District is 1041 acres; and the rateable value is £29,925. The town, however, is a compact one, well laid out, and occupies some 110 acres. While the part to the east is occupied by ironstone mines and iron-works, that lying west is agricultural land extending to the River Trent.

Previous to the carrying out of the works described in the paper, the water supply was derived from shallow wells sunk through the subsoil, with a sump formed in the ironstone—a source particularly liable to contamination. But even this supply, bad as it was, failed through the quarrying of the ironstone at the lower end of the district, which caused the lowering of the level of the water. Nevertheless, the failure of this source of supply cannot be looked upon as altogether a calamity, as it emphasized the necessity for the provision of a reliable potable supply, free from contamination.

In 1895, the Urban District Council consulted specialists, and, upon the advice given, adopted a scheme for obtaining a new supply from the new red sandstone, and powers to borrow the necessary capital for the works were obtained from the Local Government Board. A deep bore was put down by Vivian's Boring and Exploration Company, Limited, of Whitehaven; the author being the Engineer-in-Charge. This was commenced 21 inches diameter, and finished, after many difficulties, 8¼ inches diameter at a depth of 1767 feet. All marl waters and those from the upper sandstones were excluded by means of screwed lining tubes carried to a depth of 1567 feet. Final pumping tests proved the existence of an abundant supply; but, on analysis, the water, which was entirely free from organic impurities, revealed the presence of mineral impurities in excessive quantities—viz., a total of 388·5 grains per gallon, including 146 grains of calcium sulphate, 31 grains of calcium chloride, 53 grains of magnesium chloride, and 31 grains of sodium chloride. No doubt, these were due to the presence of saliferous beds in the lower sandstones. During the later stages the advice of Professor Boyd Dawkins was sought, and every endeavour made to secure satisfactory results, but without avail.

While the work of boring was proceeding, the Urban District Council obtained (in 1899) an Act of Parliament for gas-works purposes; and the necessary powers in regard to water supply were added thereto. When it was proved beyond question that the nature of the water from the deep bore precluded its use as a supply for the town, the author was instructed to draw up a scheme for taking water from the Oolites with the Risby Warren as a gathering-ground. Parliamentary powers for this were obtained by the Scunthorpe Water Act, 1903. The Warren is a natural basin falling east, totally uncultivated, entirely devoid of habitation, and hence totally free from manurial or drainage contamination, and by reason of the nature of the soil not eligible for either agricultural or building purposes.

The Scheme.—The water is pumped from an underground tank by means of electrically-driven pumps, which are in duplicate, through 2 miles of 9 inches diameter pumping main, against a maximum head of 240 feet (including friction), to a storage reservoir of 750,000 gallons capacity situated at an altitude of 226 feet. The highest point in the town is 132 feet above Ordnance datum. From the reservoir the water gravitates to the town some two miles away. The power station where the electrical energy is generated is situated at the Council's gas-works, 4¾ miles distant from the pumping station; the energy being conveyed by means of armoured cables laid underground.

Pumping Station.—The pumping-station occupies an area of 2 acres. The subsoil for a depth of 3 feet was sand, followed by 10 feet of heavily watered gravel and 22 feet of limestone also charged with much water. Here an intercepting underground tank, 150 feet long by 22 feet deep and 10 feet wide, was formed near the foot of the fault and at the extreme eastern end of the gathering-ground. The sides and ends were walled to a depth of 10 feet with 18-inch brickwork resting on the limestone, the sides being stiffened by arches at 22 feet centres upon which a roof of ferro-concrete was constructed. A 6-inch trial bore put down in the bed of this tank gave a water level in the tank 4 ft. 7 in. above the level of the stream, which was some 20 feet away. The foundations for the engine-beds are carried down to the rock 10 feet below ground line, and the basement is excavated to form a pipe subway and store.

The machinery comprises one set of horizontal three-throw pumps, belt-driven from a 50 H.P. "A.C." motor. The pump, which was made by Messrs. Frank Pearn and Co., has interchangeable barrels and slipper guides to the cross-heads, and is capable of pumping 25,000 gallons per hour against a total head of 240 feet (including friction). The rams are 10 inches diameter by 12 inches stroke, of cast iron cased with gun-metal, working through gun-metal rings, and gun-metal bushed glands. Valves and seatings are of gun-metal, cranks of forged steel working in gun-metal adjustable bearings, connecting-rods of best hammered iron, fitted with gun-metal adjustable bearings at each end, and first motion shaft of steel working in gun-metal bearings. The efficiency of the pump was guaranteed by the makers to be from 85 per cent. to 92 per cent. of the theoretical capacity. The motor is a 50 H.P. 2200 volt three-phase 25 cycle "A.C." short-circuited type induction motor, running at 480 r.p.m. The efficiency guaranteed is as follows: Full load, 88 per cent.; half load, 87 per cent. Power factor, full load, 90 per cent.; half load, 78 per cent.

A duplicate pumping plant is provided, consisting of a multi-stage high-lift turbine pump of the same capacity as the three-throw set, having three stages, and running at 1440 r.p.m. The pump is driven by a 50 H.P. "A.C." motor through flexible couplings, the pump and motor being fixed on the same bed-plate. The pumps have cast-iron casings, the impellers and guide passages being made of special phosphor-bronze. The shaft is made of nickel steel running in ring-oiled bearings. This pump was made by the Worthington Pump Company, Limited.

A telephone installation is provided, giving communication between the reservoir, the engineer's office, and the power station respectively.

Storage Reservoir.—This is situated on a site having an area of one acre; and it has a capacity of 750,000 gallons. It is built half above and half below the natural ground level, and the whole of the aggregate required for the concrete walls was supplied from the excavated limestone; the remaining spoil being used to form the bank. The reservoir is 150 feet long, 80 feet wide, and 12 feet deep (inside dimensions); the walls being battered on the inner side from 3 feet thick at the base to 2 feet thick at the top, and made of 1 to 5 concrete. The floor is 12 inches thick, of concrete resting on the solid rock. The reservoir is divided into two equal parts by a division wall 5 feet high. The roof is formed of armoured concrete 6 inches thick, supported on cast-iron columns, anchored to bed-plates, with 8 in. by 5 in. R.S. girders between them. There are four

rows of columns, dividing the roof into five bays, placed at 12 feet centres. Cross girders 6 in. by 4 in. are placed across the bays between the 8 in. by 5 in. girders, forming bays 12 ft. by 15 ft. in the clear. The roof was laid upon stout centring covered with oiled paper, and was armoured with expanded steel, having a 3-in. mesh and $\frac{3}{16}$ in. by $\frac{1}{4}$ in. section. The walls are capped with special channel coping 18 inches wide, of Victoria stone, overhanging the outer face of the walls 6 inches, in order that the roof water cannot percolate between the walls and the bank. The roof water is conducted from these channels down the face of the bank to surface water drains. Inlet, outlet, and washout valves are placed in pits in the footways at the base of the bank. The inside faces of the reservoir walls and the outer face of the roof are rendered with cement. All the ironwork is painted with graphite paint. The base of the bank is finished with a combined kerb and channel surrounded by a footway of red gravel.

The outlet-pipe is provided with a Venturi meter; the recorder being fixed in the office near the entrance gates. A self-recording rain-gauge is fixed on the top of the reservoir; and a self-recording barograph and thermometer are also provided, so that meteorological observations can be kept. The office is furnished with a telephone, and has a tool-house adjoining. An electrical water-level recorder is arranged so that the depth of water is registered in the engine-house at the generator station.

It will be seen that the design of the reservoir combines lightness with strength, very small water capacity is taken up by the piers, and no expense is incurred in brick arching. The sites of both the reservoir and the pumping-station are surrounded by a steel paled fence 7 feet high, with standards bedded in concrete and brick pillars.

Distribution.—The gravitation main conveying the water from the reservoir to the town is 2800 yards long and 8 inches diameter. The distributing mains in the town comprise 1114 yards of 8-inch, 276 yards of 7-inch, 642 yards of 6-inch, 6420 yards of 4-inch, and 1940 yards of 3-inch pipes, which are all spigot-and-socket pipes and coated. The pipes were supplied by the Sheepbridge Coal and Iron Company; the valves, by Glenfield and Kennedy, Limited.

Power Station.—The generating station is situated at the Council's gas-works, and comprises boiler-house, dynamo, and engine-room. There are two Lancashire boilers, each 30 feet long by 8 ft. 6 in. diameter, supplying steam at 80 lbs. per square inch to two sets of engines and generators, working either singly or together as required. Each of these sets includes a compound high-speed engine with cylinders 11 inch and 15 inch diameter respectively, and 7-inch stroke, made by Allen, of Bedford, giving a B.H.P. of 100 at a speed of 500 revolutions per minute. The makers guaranteed a steam consumption not exceeding 28 lbs. per B.H.P. per hour working non-condensing, also a mechanical efficiency of 91 per cent.

Each generator is coupled direct to its engine, and fixed on the same bed-plate, and is of the alternating current type, 2200 volts, three-phase, 25 period, 6 poles; speed, 500 r.p.m. The capacity of each generator is 17 amperes per terminal at 2200 volts and 100 per cent. power factor. The normal rated output is 65 kilowatts. Each generator is separately excited, and the field winding is so proportioned that, with constant speed, constant separate excitation, and 100 per cent. power factor, the load may be varied from full load to no load without a greater rise of voltage than 12 per cent. The efficiency of each generator at normal rated current and voltage and at 100 per cent. power factor is guaranteed at not less than 80 per cent. at quarter load, 87·5 per cent. at half load, 90·5 per cent. at three-quarters load, and 91·8 per cent. at full load.

The switchboard is in four panels, of white Sicilian marble 2 inches thick, with $\frac{1}{2}$ inch chamfer, highly polished, each panel being supported in a rigid iron framework, and supported by channel-irons. The switchboard is furnished with all the necessary switches, fuses, voltmeter equipment, ammeters, and lamps, and is adapted for future extensions. The generating plant is designed so that either set can be run through a motor-generator set, taking current at 2200 volts, and giving out current at 330 volts for charging storage batteries for lighting, or supplying light direct, and foundations are provided for a further 350 kilowatt set for lighting if needed.

Cable.—The cable from the power station to the pump-house, $4\frac{3}{4}$ miles away, is suitable for a working pressure of 2200 volts, having three conductors, each conductor being insulated with impregnated paper. These three cores are wormed together, made up circular with packing, and further served with impregnated paper. They are then sheathed with lead, yarned and armoured with two stout tapes of steel, and finally yarned and compounded over all. Each conductor has an area of 0·022 square inch.

General Features.—The inaccessibility of the pumping-station for carting fuel, &c., rendered the adoption of electrical energy a *sine quâ non*. The question of adopting power gas, oil, or steam motive power was fully considered; but the peculiar nature of the undertaking decided the author in favour of electricity. The special and unique features of the scheme are the distance of the pumps from the power-station, the adoption of high voltage three-phase current, the use of armoured cables laid direct in the natural soil, the adaptability of the pumping-plant for use for electric light, and of the electric light plant to serve as a duplicate pumping plant.

Efficiency of Plant.—After the plant had been running for over four months, tests were made with the generators and three-throw pumps. Though the pumps were guaranteed for a lift of 240 feet, the actual head was only 160 feet, and at 40 revolutions (400 gallons) per minute, the theoretical horse-power required equals 19·4. The actual electrical energy, however, was $4\frac{1}{2}$ amperes; and with a tested load on the outers the ampere-volts equalled 16,560, equivalent to 22·2 H.P.—showing a mechanical efficiency of 87·4 per cent.

Cost.—The estimated cost of the works was £16,960, and the actual cost was £17,213; the cost of the reservoir worked out at £2 13s. per 1000 gallons capacity.

Discussion.

The President said he could not understand how it was possible for Mr. Cobban to lay the 8-inch main in the town at so low a price. It was more than they could do in the roads in Windsor to get the pipes down to a depth of 3 feet at only 1s. 10d. a yard; it would cost them at least 3s. per yard. The work was rather hard for the men if the roads were as solid as they were in Windsor. However, he congratulated the author on the figure for which he had done the work.

Mr. W. G. Peirce (Richmond) asked the author to give the members the rate of wages paid to the ground men and jointers. The cost of the work seemed very low indeed.

Mr. T. Molyneux (Stockport) remarked that, in the portion of the paper dealing with the storage reservoir, he noticed that the aggregate required for the concrete walls was supplied from the excavated limestone. He should like to know whether the author had had occasion to examine these walls since he used the limestone, and whether he had found any wastage. He (Mr. Molyneux) would also be pleased if Mr. Cobban would give them the cost of pumping per 1000 gallons.

Mr. W. R. Locke (Hemel Hempstead) asked what quantity of water the author received from his 6-inch borehole per hour, and also the proportion (if any) that he obtained from his weep-holes. The author had provided an overflow into the tank; and he (Mr. Locke) would be pleased to learn if he had found any variation, and, if so, how soon after a fall of rain.

Mr. J. H. Secker (Slough) said he noticed the reservoir loop was built of wrought-iron girders and concrete, and was not covered with earth. He should like to know if there was any arrangement made to compensate the expansion and contraction of the roof due to the heat of the sun in summer.

Mr. W. Gore (London) thought that the most interesting feature about the paper was summed up in the paragraph in which the author referred to the electrical transmission scheme. He had had, on the one hand, experience of three-phase transmission schemes, and on the other of pumping plants for water-works, but none of the combination. The cost of the energy was not everything, because the interest on capital and the maintenance in most water-works schemes quite swamped everything else. Then in most schemes of this size, the attendance cost more than fuel. In the case of the scheme that Mr. Deacon and he had laid before the members, the wages of the attendant who resided at the pumping-station and half those of a lad was nearly twice as much as the cost of the fuel. Would the author state what was the cost of attention in this particular instance? Another thing which struck him was that the material parts and consequent risks of breakdown were multiplied. He did not see that the author had provided a duplicate cable. Had the author also considered

bare overhead wires, because in an uninhabited district such as he had referred to, overhead wires offered many advantages? There was also the question of the instantaneous power, at the generating-station, to be compared with the rated power of the motor at the pumps.

Mr. F. W. Hodson (Loughborough) congratulated the author on the cheapness of his pipe-laying, and also on the cheapness of his reservoir. It would be interesting to know on what the costs were based. He would also be interested to learn what were the reasons for the adoption of the very expensive form of electric pumping at Scunthorpe. The only reason given in the paper was the inaccessibility of the pumping-station for carting fuel. They had 4 or 5 miles of cable, involving a heavy capital cost, a great deal of risk, and a great deal of waste; and afterwards the reconversion of the current by the motor into power at the pumping-station. With a bit of leather belt, and the engine at the end of it at the pumping-station, a great deal would be saved—generator, cable, motor, and three distinct sets of losses. The author stated that the efficiency of the generators was about 90 per cent. at the low load at which it was working. There was also another percentage on the cables which was not given—say, 90 per cent. again. Then for the 50-horse power motor working at half-load, 87 per cent. was given; and for the pumps, from 85 to 92 per cent. It seemed therefore that the figure of 87·4 per cent. must again have left something out. What he (Mr. Hodson) would like to know was the actual quantity of coal used per 1000 gallons of water pumped into the reservoirs, or some figure by which the members could compare the actual cost of pumping this water by electrical power as contrasted with direct steam or suction gas. That was where the great interest of this paper lay.

Mr. H. Preston (Grantham) said he had known the Scunthorpe works from their inception; and he had been interested in them chiefly from the geological point of view. He had also taken some interest in watching the development of the mechanical side. As to the mechanical arrangements, there had been some discussion regarding the Scunthorpe high-pressure centrifugal pump in connection with a previous paper; but he (Mr. Preston) thought it was scarcely understood at the time that the two systems—the three-throw pump and the centrifugal high-pressure pump—actually pumped through the same main. The difference between $4\frac{1}{2}$ and 7 amperes, and the pumping heads of 180 feet for the three-throw pump and 260 feet for the centrifugal pump, were explained by some mechanical defect in the attachment of the centrifugal pump to the larger main. Referring to the particulars given by the author as to the original boring, Mr. Preston suggested that Mr. Cobban should publish the full sectional details, as well as the analysis of the water, in the "Transactions" of the Association. He added that, as there had recently been finished another interesting boring at Lincoln, it would be of value to the members if Mr. Barron or Mr. Percy Griffith would furnish similar particulars in regard to it.

Mr. George Greenslade (South Hants Water-Works Company) remarked that the members were greatly indebted to the author of the paper for giving them so much detail. One thing that particularly struck him was the extraordinary cheapness of the work that had been carried out. A question had been asked as to the wages paid. He (Mr. Greenslade) would like to inquire whether the work was done by contract or own labour. Another point was as to whether there was any special reason for the inlet-pipe for the reservoir being taken in at the top and carried to the bottom. He took it there were separate inlet and outlet mains. Information as to the cost of the Venturi meter and fixing would also be welcome; if the author could not give the cost precisely, a rough idea would answer the purpose. The consumption per head of the population would also be interesting.

Mr. W. Phelps (Shepton Mallet) thought there must be some mistake as to the efficiency of the whole plant, which was stated to be 87·4 per cent. Taking the guaranteed efficiency for the pump at (say) 90 per cent., and the guaranteed efficiency of the generator as mentioned in the paper at 90 per cent., it was evident they could not, even without any wastage, get a mechanical efficiency of 87·4 per cent. Perhaps the author would give a little more information on this point. He (Mr. Phelps) had not had any experience in electrical transmission; but from inquiries recently made, he had come to the conclusion that the losses on a short length of cable would be serious, and one would imagine it would be very large on this $4\frac{3}{4}$ miles. On another point, which was not mentioned in the text of the paper, he observed from the plans of the reservoir expanded metal appeared to have been placed in the centre of the concrete slabs forming the roof. This was quite contrary to the usual practice; and he thought contrary also to theoretical reasoning. He would like to know if it had actually been so placed. Regarding the concrete, he asked if it was Oolitic limestone that was used. He presumed it was. He had tried concrete composed of this material. It had not been in a great while yet, but so far it appeared to be satisfactory. He could, however, well believe that, under certain circumstances, it might be liable to deterioration.

Mr. Percy Griffith (London) said, as Mr. Preston had referred to the Lincoln boring, perhaps he (Mr. Griffith) might take this opportunity of—should he say?—"giving himself away." He found himself in very great sympathy with the author of the paper. He had described to the members very briefly, and, as Mr. Preston had said, rather too briefly, the details of his deep boring into the new red sandstone. Mr. Cobban's town was situated in North Lincolnshire. He (Mr. Griffith) was very sanguine that, having a successful boring into the new red sandstone at Gainsborough, which was geographically situated between Scunthorpe and Lincoln, that the result at Lincoln would have been satisfactory. But it was now clear that the governing factor with regard to the quality of the water was, as Dr. Thresh told them the previous day, the depth below the surface, and not the geographical position on the surface. The results at Lincoln were so very similar to those obtained at Scunthorpe, that it was more than probable, and almost a certainty, that the same causes had operated in both cases. It might interest members if he stated that the Lincoln boring was finished at a depth of 2200 feet; the diameter at the bottom being 24 inches. The water was tapped at a depth of 1560 feet; and in the course of 36 hours, it rose to the surface, and had ever since been overflowing at the rate of approximately 200,000 gallons a day (without pumping). When these conditions were first revealed, a favourable result was naturally anticipated. As regards yield, there was every prospect of obtaining $1\frac{1}{2}$ million or even 2 million gallons per day, by pumping at a sufficient depth, but as the analyses of the water gave worse results as the boring proceeded, it was realized that the water was useless for public supply and the scheme would have to be abandoned. This was more than ordinarily disappointing, as the work involved an expenditure of more than £22,000 to the Lincoln Corporation. Naturally they were very disappointed; and he felt sure they would have the sympathy of all—especially engineers—interested in the obtaining of a good supply of water. As to the detailed information asked for by Mr. Preston he (Mr. Griffith) would undertake that the information should appear in the "Transactions," but for the moment he was not in a position to promise definitely to give the Association the first paper on the subject. He thought it would be interesting if he could induce Dr. Thresh to deal with the analytical data in a paper to be presented at the same time as a paper describing the engineering features of the case. As to the details of the Scunthorpe boring, he was going to anticipate Mr. Cobban's reply to that by saying that Mr. Preston was himself responsible for publishing these details in the "Geological Memoirs;" and all who were interested in the question of geology and water supply would have the "Memoirs" by them.

Mr. Preston supplemented his previous observations, by permission of the President, relative to the question of the use of limestone for concrete. He remarked that a short time ago he had to construct a small reservoir; and he intended to use local limestone for the purpose, but was advised it would deteriorate when the water got on to the concrete. He had some concrete which had been under water for something like eighteen years; and before he constructed the reservoir, he took up some of this, so as to try the experiment. He found the water had had no effect on it; he could not trace on the surface even a little decay. Where such a thing did take place, it was owing to an upland water being used which would act on the limestone, but where water such as their own was fully charged with carbonate of lime, it would have little action on the limestone.

Mr. Arthur Andrew (Oldham) asked whether the cost of pipe-laying included any item for reinstatement of roads. Usually, the cost of this item was not less than 9d.

Mr. Cobban, replying to the discussion, said if he answered the President's question as to the price of main-laying, he

should at the same time be giving a reply to several other members. He was pleased to say the prices quoted in the paper were the actual prices paid by contract. He had an excellent contractor; and all the work was by contract, and paid for on the contract price without any extras whatever; and the contractor had to provide all the yarn, the lead, and the tools, light, watch, and guard the excavation, and reinstate the roadway at the tendered prices, measured as laid. For the straight pipes and for the specials on the pipe-line, the figures in the paper were the actual payments on the certificate. As to the rate of wages paid, the contractor paid them; he (Mr. Cobban) had nothing to do with that. As to the question by Mr. Secker, who asked as to the expansion of the concrete by atmospheric influence, this was neutralized by the use of expansion joints and bitumen. Regarding the use of expanded steel in the roof of the reservoir, wood-centering was put in; this was covered with brown paper and oil or soft soap applied; then right over the top of the girders, the expanded steel in long sheets was hung, resting on the centering. The concrete was then put on; and it had a tendency to rise in the first 1 or 1½ inches of concrete. But it overhung the girders so as to make a light connection therewith. He had been asked about the rainfall, and whether there would be any use for an overflow. He had been labouring here with rainfall very much below the normal; and so he could not say whether or not the overflow would be used. The question had been raised regarding the use of limestone in the concrete; but Mr. Preston had answered that. He (Mr. Cobban) took particular care to select hard limestone. It had been used for many years for farmhouses; and he did not think there would be any disintegration. The softer limestone was utilized for footpaths and roads. Mr. Gore had put his finger on the only blot in all the scheme, and that was the cable. To neutralize the effect of only having one cable, access boxes were placed so that any fault in the cable could be localized very rapidly. The reservoir gave them storage of 750,000 gallons, so that would allow them time to run along their cables and localize any defect; and their own electrician could do this. Another question was asked as to the losses in transmission. The loss on the three-phase voltage (they were running at 2200 volts) was very small indeed—a drop of only 120 to 130 volts in the 2200. An inquiry was made as to the cost of the Venturi meter. He did not think his cost would be a fair figure to work upon. It would be found that the cost of the Venturi meter varied with the circumstances in which it was fixed; and any one case would not serve as a guide in another. As to the point made regarding the inaccessibility of the site, it was argued that if the site was inaccessible for the coal, it was also inaccessible for the pipes. But the pipes had only to be conveyed once; while the coal had to be conveyed every day. It was necessary therefore to convert the coal into a form of energy that could be easily transmitted. His power was in the nature of a bye-product of the gas-works. He did not need to use much coal under his boilers; any spare rubbish coming from the gas-works—such as breeze, coke, or even sweepings—would be used. His electricity, therefore, was more in the nature of a bye-product. He was supplying steam for the purpose of running plant at the gas-works—the tar-pumps, the ammoniacal liquor and water pumps, two exhausters, and other plant. Having the steam power plant at the gas-works, he went forward, and had a power-station there, and so generated the energy for the pumps. Regarding overhead wires, they were prohibited in his case. The estate was a big sporting one, and they were not allowed to put up overhead wires.

Mr. Peirce: If Mr. Cobban cannot give us the price of labour in this particular case, will he give us the average price in the district?

Mr. Cobban said the labour scale was a pretty good one. He believed they paid some of the labourers 6d. per hour; but most of the work was paid for by the yard.

Gaslight and Coke Company's Dividend.

We are informed by the Secretary of the Gaslight and Coke Company (Mr. H. Rayner) that the accounts for the past half year show that—subject to audit—the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 8s. per cent. per annum, carrying forward a balance of £306,992 6s. 10d. This result compares with a dividend at the same rate for the June half of last year, with a balance of £210,481 carried forward.

PHOTOMETRY OF DIFFERENT COLOURED LIGHTS

By M. Lauriol.

Chief Engineer of the Paris Roadways, and Chief Engineer of the Public Lighting of Paris.

[Translation of a Paper presented last Thursday to the International Photometric Committee.]

I.—Briefly, it will be taken for granted in the sequel that (1) the absorptive power of the air can be neglected, and (2) the dimensions of the sources or groups of sources of light are infinitely small in comparison with the distance from the objects illuminated. As most sources have different illuminating intensities in different directions, when the intensity of a source or the effect produced by it is spoken of, it will be understood that these expressions apply to a particular direction.

II.—Experience furnishes us with a first general law—viz., a source A, acting at a distance a, produces the same effect as a group of n^2 similar sources acting at the distance na.

When a source A is compared with a standard of the same colour E, the intensity of A measured relatively to E is by the definition the ratio $\frac{e}{a}$, which results from the condition that a group of sources e similar to E produces under all circumstances the same effect as a group of sources a similar to A. The law set out at the beginning of this paragraph admits of another definition of intensity being given—viz., it is the ratio $\frac{u^2}{v^2}$ which results from the conditions that the source A acting at the distance u produces the same effects as the source E acting at the distance v.

III.—The intensity so defined has, in monochromatic photometry, a perfectly clear meaning, and is indeed an inherent property of the source under consideration. The figure found is independent of the mode of measurement, and of all the circumstances of that measurement, of the nature of the effect which one endeavours to balance, of the absolute values of the numbers a and e on the one hand, and u and v on the other hand, &c. All the modes will theoretically be equally good; and choice will be guided simply by considerations of convenience or of exactness. The intensity of a group of sources is equal to the sum of the individual intensities of each source. The relation between the intensities of the two sources is independent of the common unit by which they are measured. To sum up, it is justifiable to state that the intensity so defined gives an exact measure of the value of the source.

IV.—When two sources of different colours are compared, the conditions are changed. The effects produced by two sources will not always be the same; but in certain cases it will be possible merely to judge that they are equivalent. This judgment carries a greater uncertainty the greater the difference between the two colours. Further systematic differences are introduced, depending on all the conditions of measurement. A source of light no longer has a certain intensity, but an infinity of intensities according to the mode followed, and with the same mode according to various numerical experimental data. The principal causes of variation will be enumerated later. Then there is the radical and absolute impossibility of saying that a source A is twice or three times the value of another source B. All that can be said is that in a first case, a second case, or a third case the source A had a value twice, or two-and-a-half times, or thrice the value of B. Which figure is to be chosen to represent the value of the source A? Scientifically, all these figures are properly applicable, if the conditions under which the measurement was made have been clearly defined. Practically, if a batch of conditions can be found corresponding more or less to the customary conditions of use of the sources of light, the measure thus made will give a more or less satisfactory measure of the value of the source.

Let us take an example from a somewhat different order of ideas. The relative volume of two masses of gas is a well-determined quantity, if the two masses are similar in character and both are at the same temperature and pressure, whatever that temperature and pressure may be. On the other hand, the number of litres occupied by a given mass of gas is not definite; and no one can say, without further qualifications, that a kilogramme of air occupies 1000 litres. If, however, it is known that the temperature and pressure vary only within certain sufficiently narrow limits, it will be possible to say that a kilogramme of air occupies a space of 1000 litres. The case of the photometry of lights of different colours is quite analogous.

Various definitions of the intensity of lights have been selected from among the many available. For instance, (1) the relative intensity of the sources after filtration through a monochromatic screen which allows only certain radiation at the limit of the yellow or the green to pass; (2) the limit towards which the relative intensity approaches when the illuminations approach zero; (3) the integral of impressions obtained on a photographic plate by making each radiation act in succession for a given time, which is a function of the wave-length. None of these definitions is *per se* good or bad. Do they correspond with the average conditions in practice? That is the only question. To accept or reject one or the other, comparison must be made with the average conditions in practice. After that, it is easy enough to take at the outset these average conditions, and to make the

measuremeuts directly under the conditions. This is what the author purposes trying to do, without making any pretence of avoiding arbitrariness, but only giving it as small a part as possible.

V.—At the outset, we may somewhat ingenuously recall the fact that the sources of light enable us to see the illuminated objects. To keep to the general practical case, we ought only to depend on pheuomena of light, sensible to our eyes, and consequently to photometers properly so called, and so to exclude apparatus such as the selenium pile, bolometers, or photographic plates. The figures thus obtained will evidently have no particular value for a medical man, who looks for certain physiological actions by a focus of light, or for a photographer, who looks for certain chemical effects, &c. But it is necessary to keep within limits.

VI.—Various physicians and physiologists—among others M. André Broca—have shown the influence which fatigue of the eye, more or less severe, and the duration of the impression of the light, cause on measurements. In an analogous train of ideas, the author has found variations of 20 per cent. in the relative intensity of a Nernst lamp and an ordinary electric glow lamp, accordiug as it was measured with the Simmance-Abady flicker photometer as normally worked with the disc rotating, or with the same photometer with the disc at rest so that the equality of illumination was judged on the two juxtaposed surfaces at rest. Practically the objects, whether fixed or moving slowly, which are beiug observed, retain constant illumination for au infinite period (*i.e.*, a second or more); they are observed with an eye which has received the impression of the surrouuding light for an infinite period (a second or more), aud is fatigued to an extreme extent. We shall have to work under these conditions, which are those obtaiuing in all photometers with fixed surfaces, to the exclusion of flicker photometers.

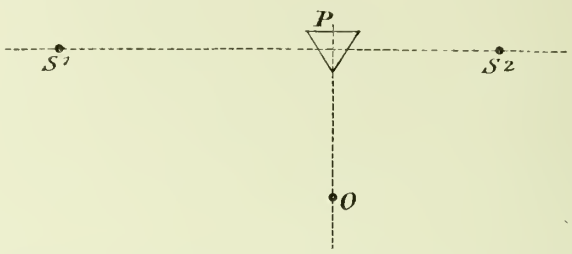
VII.—The apparent diameter of the surfaces of observation appears to have an influence, which is still imperfectly known, on the results of the measurements. It would appear that, accordiug as this diameter varies, the image reaches or fails to reach various parts of the retina of varying susceptibility to impressions. Practically illumination is of most value to us in the direction determined by the eye, or in its vicinity. Consequently, tests should be made to ascertain a maximum limit for the diameter viewed, below which we ought always to stop.

VIII.—Objects of every colour have to be observed set on backgrouuds of every colour; and in this lies the possibility of the relative values of two sources varying to a very great extent. A weak source of green light will be superior to a powerful source of red light, if green objects have to be distinguished on a black ground or red objects on a white ground, or *vice versâ*. A single measurement of the relative intensity of the two sources will therefore give a figure differing very greatly from their truc relative value under different conditions. The least objectionable solution in such a case will be to compare the illumination of two white surfaces, just as is done in the majority of photometers.

IX.—The intensity found varies with the absolute illumination. this is one of the facts which have been investigated longest. For instauce, the intensity of a Nernst lamp, measured relatively to that of an ordinary electric glow lamp, has been found to vary between the ratios of 100 to 80 and 100. In this instance, the absolute illumination varies within less wide limits than those between which it varies in practice. In this special case, it is noticeable that the variation is not in a constant sense. It is scarcely possible to choose au average condition. There are variations from 1000 *lux* to 0·1 *lux* between the maximum illumination of a work-table and the minimum illumination of a public street. In general, the sources ought to be tested over these limits; but it is between 50 *lux* and 0·5 *lux* that the measurements are specially of interest.

X.—The intensity found varies as a function of the absolute illumination, but of the absolute illumiuation of what? Clearly it can only be as a function of the illumination of the images on the retina. Therefore every cause which produces variation of the illumination of the images on the retina, while the illumination of the photometric screen remains constant, will produce a variation in the figure found for the relative intensity of two sources. If, when making an observation, we wink, or obscure the pupil of the eye, we cause the illumination on the retina to vary, and we observe variations of the apparent relative intensity. This fact has been pointed out by M. Laporte. It will be seen that only one thing cau be done in this couuection—viz., to keep the eye naturally open when makiug an observation, and to compare the results obtained by different observers.

With identical illumination of the photometric screen, the illumination on the retina varies with the photometer used, according to the reflections, refractions, diffusions, and absorptions inherent to each instrument. Also, it will be fouud that, for the same distance between one of the sources and the photometer, the apparent intensity varies with the photometer used. We ought therefore to select a photometer which reduces to a minimum all these modifications of the light, and which shows us the screens as nearly as may be like we see objects in general practice. Generally we observe matt opaque surfaces at all possible angles of incidencc. As an average, let us assume that the incident ray and the visual ray are perpendicular to one another, and are both at 45° to the vertical. Between the source and the eye, the light undergocs no other modification than diffusion at the surface of these objects. It ought to be the same with our photometer. Therefore the author suggests the following method with which



some observations have been begun. On a rectilinear horizontal bench are mounted the sources of light S^1 and S^2, and the photometer P (see annexed figure). The latter consists of an isosceles rectangular prism, with vertical edges. The plane bisecting the angle ought to be perpendicular to the direction of the bench. The eye is put at O in the bisecting plane, at the same height as the photometer and the sources of light. The prism is made of plaster, unglazed porcelain, or any other white matt material. The edge of the facing angle ought to be as sharp as possible. Equality, or at least equivalence of the illumination of the two lateral faces of the prism, is obtained by moving either the photometric prism or the sources of light.

Such a photometer affords a less precise observation than others—such as the Lummer-Brodhun; but it comes nearer to the average conditions of practice, and avoids systematic errors. There is greater reason still for discarding photometers in which the light traverses a translucent screen, like Foucault's photometer, and more particularly the grease-spot photometer, as the phenomena differ too much from the ordinary conditions of practice.

XI.—The intensities being thus measured, the following law (which the author brings forward with all reserve, as it has not yet been sufficiently verified) appears deducible from the tests: *Two illuminations which are equal to a third are equal to one another.* Suppose that the two following results had been found:—

The source A at the distance *a* is balanced by the source C at the distance *c*.
,, ,, B ,, ,, ,, *b* ,, ,, ,, ,, ,, C ,, ,, ,, *c*

Then the law cited would indicate that—

The source A at the distance *a* is balanced by the source B at the distance *b*.

If this law were more completely verified, granting the laws of variations of the relative intensity of two sources A and B, and of two sources A and C, we should be able to deduce from it the law of variation of the relative intensity of the two sources B and C. Thus, from the two data—

A at the distance *a* is balanced by B at the distance $f(a)$;
A ,, ,, ,, *a* ,, ,, ,, C ,, ,, ,, F (a);

we should deduce that

B at the distance $f(a)$ is balanced by C at the distance F (a).

Giving *a* all possible valucs, we should then have the law of variation of the relative intensities of B and C. Given the law of variation of intensity of a source by refereuce to a primary standard, and that of this standard by reference to a secondary standard, the law of variation of the intensity of the source in relation to this secondary standard may be deduced.

XII.—When all this is done, there are still troublesome considerations in the way of conducting the photometry of lights of different colours, which at any rate render it necessary to make very numerous observations in order to get a result having any meaning. The intensity of a group of sources of light is, generally speaking, different from the sum of the individual intensities of the sources. There is notable inequality in the case where each source is placed separately, and later the whole group, at the same distance from the photometric screen.

The law of variation of the iutensity of a source, as a function of its distance from the photometric screen, will not remain the same if the standard used for the measurement is altered. If the intensity of the standard is simply modified, without altering its colour, a curve can be deduced from the other curve by increasing or diminishing the ordinates in constant proportion. If the colour of the standard is modified, measurements such as those indicated in Section XI. will have to be resorted to. Generally, it will be inexact to multiply the ordinates of a curve by the ratio of the intensities of the two standards, as determined by a single observation on any photometer, and with only one distance between one of the standards and the photometric screen. In particular, for comparing the three standards, the Carcel, the Harcourt, and the Hefner, it would be interesting to have a detailed investigation made with various illuminations and various photometers.

XIII.—Though the intensity of the standard is theoretically a matter of indifference, its colour is uot. As comparison with natural sunlight is desirable, a standard should be chosen which comes as near as possible to the colour of suulight when atmospheric absorption is at a minimum. So judged, the Carcel aud the Harcourt standards appear superior to the Hefner. Perhaps a better may be found.

XIV.—In many cases, comparison is between lights of almost the same colour; and no comparisons have to be made with other lights of different colours. For instance, in comparisons of Welsbach burners of different makes one with the other, the chief interest lies in ascertaining their value relatively to oue another without troubling greatly about their value relatively to a Carcel lamp or an electric arc. Or the variations of intensity

of a source of light with change of direction might be studied In each of these cases, it would be convenient to adopt a special standard of appropriate colour, rather than to refer both to the same standard. For instance, special standards would be used for Welsbach mantles, others for hydrocarbon flames, others for incandescent electric carbon lamps, others for lamps with metallic filaments—such as the osmium, tantalum, or tungsten lamps—others for ordinary arc lamps, and others for flame arc lamps. Comparison rests each time only between two sources of the same colour; and there will no longer be any reason for limiting oneself to the use of the photometer mentioned in Section X. In order to make the tests carried out in different laboratories comparable, it would be possible, for instance, to start with the general standard mentioned in Section XIII., and to filter the light through various coloured screens, either of thick glass of well-defined composition, or of liquids, as in Crova's green screen.

XV.—The various causes of variatiou of the apparent intensity of two sources will have so much the less effect, and may be so much the more readily neglected, when the colours are but little different, and no very great degree of precision is aimed at. It is important to make long series of measurements on this point, principally with colours much whitened, as is the case with the most general sources of light. The collaboration of numerous laboratories would be useful to this end.

XVI.—To sum up, the author submits this programme: Try the photometer described in Section X. Investigate the discrepancies due to difference of eyesight. Investigate the effect of the apparent diameter of the screens, and, if it seems desirable, fix a maximum diameter (Section VII.). Compare the Carcel, Harcourt, and Hefner standards with the photometer described in Section X., and investigate the variations of relative intensity as a function of the absolute illumination and of the various photometers employed. Verify the law of illumination referred to in Section XI. Choose a primary standard having, as nearly as may be, the colour of solar light (Section XIII.). Choose secondary standards having the colours of the various common sources of light (Section XIV.). Make measurements of intensity in the photometry of different colours for illuminations varying from 1000 *lux* to 0·1 *lux*, and in particular for illumiuations rangiug from 50 *lux* to 0·5 *lux*. Investigate the degree of approximation to accuracy with which it is possible to assign a particular intensity to each of the various common sources of light (Section XV.).

Thorium-Cerium Mixtures.

In a recent number of the "Berichte des Deutschen Chemischen Gesellschaft," the subject of thorium-cerium mixtures was dealt with by Herren R. J. Meyer and A. Anschütz. According to an abstract in the "Chemical News," the authors contended that an incandescent mantle of pure thorium oxide is not luminous because it is perfectly transparent to almost all wave-lengths; but the addition of a coloured substance, such as cerium dioxide, produces the characteristic luminous effect. The maximum of radiation when 1 per ceut. of cerium dioxide is present represents the upper limit at which the increase in the power of emission caused by the increase in the amount of ccrium is not appreciably affected by the disturbing influence of the ultra-red emission. Regarding the question from a chemical point of view, if such oxide mixtures are solid solutions in which the component preseut in excess—viz., thorium oxide—represents the solvent and the other the solute, it remains to be decided between what limits the two oxides are homogeneously miscible with one another, and whether chemical individuals are formed. These questions would easily be answered if it were possible to determine the melting-points of mixtures of different composition, which, however, is not feasible. There is also the question whether in such mixtures the cerium is actually present as dioxide and not wholly or partly as sesquioxide. To investigate this poiut, the authors first tried to ascertain whether any oxygen escapes when thorium oxide and cerium oxide solutions are evaporated together; and they obtained a negativc result. However, the method employed was open to objection; and hence the active oxygen in the syuthetic oxygen mixture was determined iodometrically. It was then found that only a certain part of the cerium used reacts with hydriodic acid, liberaing iodine; and thus some of the cerium has been bronght into the passive state—*i.e.*, some of the cerium oxide suffers a change, and loses its oxidizing properties. Further experiments show that homogeneous solutions of the two oxides cau be prepared up to a maximum of 7 per cent. of cerium oxide; but it is not certain whether this maximum percentage represents a compound of 93 per ccnt. of thorium oxide and 7 per cent. of cerium oxide, which would have the formula $9ThO_2.CeO_2$. It is possible that the maximum effect is produced when 1 per cent. of cerium oxide is present, because the emission of light does not proceed from the whole mass of dissolved cerium, but from the dissociated parts; and that the maximum of effect correspouds to that dilution at which the solution is completely dissociated.

The Conncil of the Institution of Civil Engineers have appointed Sir William Matthews, K.C.M.G., the President, to succeed the late Sir Benjamin Baker as one of their representatives on the principal Committee of the Engineeriug Standards Committee.

THE BLOCK LIGHT.

Extension of Home Manufacture of Mantles.

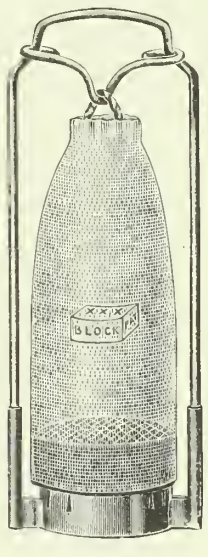
It was only a question of time when the manufacture of incandescent gas mantles for home consumption would become largely concentrated in this couutry. The process has been going on; and the assertion of interested parties that incandescent mantles could not, owing to climatic influences, be made so well in this country as in others, has long since been nullified beyond all hope of further credence. There are mantle manufactories in this country of extensive capacity, and specially designed for the work, which are now permanent institutions, and which have brought to England a new industry. We will not name them all here, as most of them are well known. It is the latest of the establishments that call for notice to-day, in view of a special invitation, issued to interested technical and trade papers to go and inspect them, witness the processes, and state what was seen, with the impressions of the visitors. The Block Light, Limited, Clifton Buildings, Worship Street, issued the invitations; and from these commodious premises (from which all the executive and commercial work of the Company is transacted) the visitors first repaired to their newly established factory at Barnes.

New Features in Commercial Policy—A Three Months' Guarantee for Mantles.

But before leaving the City premises, some information was imparted which is of interest. In the first place, it was gathered that the mantles of the Company have hitherto been made in France and Germany; they will now be made entirely in this country by British labour. And the time is not far distant when we shall be able to write the same of their burners. That is the Company's manufacturing objective, for the double purpose of having the producing work directly under supervision, and in order that they may come before the British public with home-made goods as one plank in their commercial platform.

Then another thing is that a three months' guarantee from date of purchase is given with certain brands of their mantles; and a three months' guarantee is a thing that strikes us as novel and bold in enterprise in the mantle world. The risks that are involved by the Company in this matter are many. They

The Block Burner.



The "Anti-Vibro" Mantle.

however, have every confidence in their proposition; and where they lead in this, they believe others will follow. Of course, the mantle is only renewed in the event of its breakage otherwise than by accident.

Further, the Company are giving the public the benefit of administrative and manufacturing economies by reducing prices; and they have made comprehensive regulations whereby the maintenance of prices will be assured in the trade (or rather it is hoped the regulations will be efficacious in this respect). Again, for the coming season they are supplying burners and mantles, in sealed boxes, at lower prices than hitherto; the object of the sealing being to prevent any tampering, on the part of unscrupulous dealers, by exchanging the productions of the Block Light Company for others of inferior make.

An Inverted Burner for Ordinary Mantles.

An object of interest that was also described at the offices was an inverted burner, made to take ordinary mantles. Incandescence of the longer mantle is obtained by perforations in the bunsen tnbe at its lower part. The whole of the mantle—that is to say, the upper part—is not rendered incandescent; but the illumiuating power and general effect are stated to be good. We have not yet seen one of these burners; and therefore cannot speak of merits from personal experience or observation. But the novelty is worth mention.

At the Barnes Factory.

The Barnes factory, which has been established under the title of the London Mantle Company, Limited, has been specially adapted to mantle making; aud everywhere one notices arrangements tending to economize in the system of manufacture.

Passing through the factory, the information is first gathered that, at this commencing stage, the equipment of the buildings is equal to an output of 7½ milliou mautles a year; while provision has been made for the extension of the plant and accommodation of employees to raise the productive capacity to 15½ millions per year, apart altogether from the production by the English Gas Mantle Company of mantles for the Block Light Company. Introduction was made to the knitting department, where, in describing the machines Mr. J. W. May (of the central office), who accompanied the party, informed them that the Company prefer to use cotton, specially prepared and unshrinkable, for their mantle fabrics; they claiming that it is better than ramie. Thus do specialists disagree. However, each of the knittiug-machines is equal to the turning out of sufficient fabric for 2500 mantles per working day; and the labour required of the attendant is very light. In passing, it was remarked that electrical driving is the fashion here. Exceeding great care is taken in the preparatory work in manufacturing the mantles; and there is not a point in the detail upon which Mr. J. I. Robbins, the Manager, has not exercised a wise discrimination, aud brought his mechanical bent to bear. In the buildings, which are themselves airy, light, and capacious, everything has been done to ensure cleanliness of operation and purity. An instance is seen in the precise methods adopted in the successive washing in different large tanks of the knitted fabric before impregnation. After this washing, the fabric is taken to a drying-floor running centrally under the roof of the spacious room where the buruing-off operatious are performed. The sides of this elevated corridor floor are only partially enclosed, so as to permit the heat from the burning-off machines below to ascend here, and supply the heat for drying. There is economy in this; and so great is the waste heat thus utilized that the temperature attained on the floor varies from 109° to 120° Fahr. The dried fabric is subsequently carefully examined; and any damaged portion is cut out and discarded. Then comes an ingenious arrangement of impregnating bath and mechanically worked rollers combined. The fabric is dropped into the impregnating bath; and then passed between a pair of rollers, set to a certain pressure, according to the weight of chemical it is desired to retain in the fabric. Adjoining the impregnating department is a drying-room, which was found at the time of the visit to be at a temperature of 93° Fahr., at about which degree the temperature is maintained by electric and gas heaters. Here the impregnated fabrics are suspended on drying-bars, and left for about forty minutes. Then we were taken to witness all the other well-known processes—the cutting in lengths, the strengthening and sewing of the heads of the mantles, the stamping, the burning off, the collodionizing, the fitting to "Anti-Vibro" frames (there are, of course, classes of mantles not so fitted), the trimming, examining, boxing, and so on. Regarding the burning-off, gas is used at 10 lbs. pressure, to which poiut it is raised by an air-compressor. In the portion of the building where the work of collodionizing is performed, it is noticed that the fumes from each machine are drawn upwards by a fan, into a hood, leading to a ventilating-shaft; and below there is also a grating through which any descending fumes are drawn, also by a fan. Each of the collodionizing or dipping machines at present installed is equal to treating 8000 mantles per day. Altogether there are 250 hands employed in this newly started factory; and this number will be progressive as the equipment proceeds.

At the English Gas-Mantle Company's Factory.

From the Barnes factory, motor cabs that had been chartered for the party took them to the large factory at Streatham of the English Gas-Mantle Company, where are made some of the Block mantles, and, in accordance with specifications, several others of well-known name in the British market. Members of the Board of the Block Light Company are also interested in the direction of this mantle company. This is the factory of which Mr. J. T. Robbins is the Managing Director; and we find here an old hand in the technical work of the incandescent mantle industry—Mr. W. Mackean, whose knowledge of the chemistry of the subject from the manufacturing side may be rivalled, but certainly not exceeded. This factory at Streatham was formerly specially built for the Dura Company; and it is laid out on the lines that experience has advised are the best, for both work and employees. Here there are spooling, knitting, and other machines equal to an output of about 17 million mantles a year; and plenty of room for more. All sorts and sizes of mantles are made at the establishment—both for vertical and inverted use.

A Machine Dealing with Several Processes.

But the great feature of the factory are the Robin machincs, which are the invention of the Manager. They are remarkable for their labour-saving capacity. There are eight of these machines, each being equal to treating 4500 mantles a day, or 1¼ millions a year; and only two young girls are required to feed the machine and receive the finished mantles. The machines take up all the work after the impregnation of the mantles; and the mautles go through all the subsequent processes with time-regulated precision, the mantles being delivered in perfect condition ready for boxing. The combination of processes is ingenious; and the efficiency of the machine appears to be very high. This is the only factory in this country so far equipped with these machines; and they have been working with great satisfaction for six months. But there are fourteen others in Germany and two in France. For the high-pressure burning off, the air to the buruer is compressed, and not the gas.

All other operations are similar to those obtaining in other factories. The motive power for the machinery is gas-generated electricity, which is useful in such an establishment where power is required at so many points distant from each other. There is a modernness about the whole place which is pleasing; and there is abundant space everywhere which facilitates the different operations. Just now, nearly 300 hands are employed; but in the height of the lighting season, there will be from 500 to 600.

NOTES ON TAR MACADAM.

At a recent Annual Conference of the Association of Municipal and County Engineers in Liverpool, Mr. C. F. Wike, M.Inst.C.E., of Sheffield, read a paper on the subject of tar macadam, with special reference to its use in connection with road making in his town.

The author began by pointing out that the employment of tar macadam for minimizing dust—for which purpose he said it was probably the best material—was by no means a recent introduction—it having been resorted to in some of the Northern and Midland towns for at least thirty or forty years. In Sheffield, tar macadam had certainly been laid nearly forty years. At present there were 392 miles of road in Sheffield, of which 241 miles were of macadam. About 151 miles of the latter were repairable by the highway authorities; and of these nearly 10 per cent. were laid with tar macadam. The proportion might seem small, but the reason for this at once brought them face to face with one of the difficulties in the general adoption of the material named for roads. Many of those in thc writer's charge had steep gradients, and no one who had had any experience of tar macadam would suggest that it was a desirable material for hills. Up to the present, a gradient of 1 in 20 had been considered sufficiently steep. At one time, most of the work was let by contract; and this was still the case to a limited extent. But about five years ago plant was constructed by the Corporation at an approximate cost of £1000—consisting of sheds, iron-plated floors, with flues beneath for drying the broken stone, and heating apparatus for the tar compound. During the last three years the quantity of tar macadam prepared had averaged 2300 tons per anuum, in addition to 900 tous of tarred chippings for footpaths.

The specification to which the tar macadam was made was as follows: First coat about 2 inches in thickness of limestone, "dark" iu colour, and of approved quality, sound, hard, and free from spar; the stone to be broken uniformly to a 2¼-inch gauge. Second coat about 1¼ inches in thickness, of best slag, of sound, uniform material, free from honeycomb and dirt, from approved works. The slag to be broken uniformly to a 1¾-inch gauge. Third coat about ¾-inch in thickness, of slag shingle to a ¾-inch and ½-inch gauge, in equal proportions, free of dust, of the quality specified for the second coat. The total thickness of the tarred material being rolled with the steam-roller to be 4 inches, and the top of its surface to be ¾-inch, above the level of the channels. After rolling, the roadway was to be covered with a dressing coat of granite or limestone chips (½-inch dust out) of approved quality and thickness, as ordered, and again rolled. The whole of the limestone and slag must be thoroughly well dried on hot plates. A mixture of pitch and tar must then be boiled in the following proportion: For the first and second coats, 90 gallons of tar and 125 lbs. of pitch; and after boiling for two hours, 17 gallons of the mixture must be mixed with 30 cwt. of the broken limestone and 1¾-inch slag. For the third coat, 14 gallons of the above mixture, after boiling, to be added to each cubic yard of shingle. The limestone and slag to be perfectly dry and warm at the time of mixing, and the whole thoroughly turned over, so that every part of the surface of the stones would receive a coating of the mixture. The above-mentioned proportions might vary according to the quality of the pitch and the strcngth of the tar. The prepared limestone and slag were then to be put in separate heaps, and left a sufficieut time to toughen before being laid. After it had been properly toughened and freshened with a further quantity of pitch and tar (if this was considered requisite), it was to be spread on the foundation in layers as specified.

The cost of slag and limestone tar macadam was about the same. If of best quality, probably slag was the better material, and, in certain instances, it had been used for all three coats. The difficulty, however, was to get it sufficiently uniform and free from lime and other constituents which rendered it liable to early disintegration. This was one of its disadvantages as compared with limestone, which could be obtained of uniform hardness; and as the use of tar macadam increased, so would the difficulty of getting sufficient slag of suitable quality. Granite had not hitherto been looked upon as a suitable material for tar macadam, on account of its want of absorption. It was laid by the author nearly twenty years ago in several streets; but, for the reason

given, it was not a success. It had recently been laid in some districts, with tarred chips for binding; and similar work was in preparation in Sheffield. If the necessary adherence could be obtained, granite would, on account of its better wearing qualities, be more economical than either limestone or slag; and, perhaps, with modern methods of tarring roads again at frequent intervals, the old difficulty might be got over.

With regard to the cost of tar-macadam roads compared with dry granite macadam, the initial cost was about the same—2s. 3d. to 2s. 6d. per superficial yard, exclusive of foundations; the extra expense of tarring being balanced by the fact that a cheaper material was used than the granite macadam usually employed for important main roads, when these were not paved. Statistics had been prepared with regard to a typical suburban road taking a considerable amount of traffic; and the annual charge (including initial cost) for a period of fourteen years had averaged 4d. per square yard. This was for a fairly flat road. In another case—a road with light traffic—the average had been a little less than 2½d. per square yard.

If the best results were to be obtained, it was very advisable that, after the first laying, tar macadam should be kept in thorough repair; and for many years it had been the practice to tar-paint the surface at intervals of three or four years, or as soon as any roughness began to show. This had been done, not so much with the idea of laying the dust, as to prolong the life of the tar macadam. At present a considerable mileage of dry macadam road was being tar-sprayed; and, so far as could be seen up to now, it would be practicable to apply this system to gradients steeper than those upon which tar macadam had been laid. Nevertheless, there must be a limit to the gradients upon which tar could in any form be safely employed, as it was a material very susceptible to heat, and slippery in hot weather.

To sum up the writer's experience, tar macadam was a suitable and economical material for many situations, and its use was bound to increase; but it had its restrictions—the principal one being that it could not be safely used for roads with a considerable gradient. So far, the materials employed had been inferior in durability to granite or whinstone; and therefore it had not been suitable for macadam roads with the heaviest traffic. The great advantages were the comparative absence of dust, and the quietness. Roads of tar macadam were also economical in the matter of cleansing. The introduction of tar-spraying apparatus had materially helped to minimize the dust nuisance; and it was through the application of tar, in one form or another, that the nearest approach to a dustless road must be looked for where paving (which, after all, created the least dust) could not be used.

In the course of the subsequent discussion, Mr. E. P. Hooley, the County Surveyor of Nottingham, remarked that after experimenting in almost every possible way, tar seemed to be the one cheap and suitable material to form adhesive matter in road construction. At the same time, tar by itself would undoubtedly not make good roads; but if it could be made to adhere permanently to any good road material, and that material could be obtained at a cheap rate, it necessarily followed that many of the expensive parts of road making could be economically dealt with. While looking for a material which would be suitable for road making, and, at the same time, cheap in its initial cost, he found that a large quantity of furnace slag was yearly cast to waste, and that by a somewhat simple process all slag, or slag which had been considered unsatisfactory for road making, could be converted into a hard and truly efficient road material. But the difficulty in the ordinary treatment of slag with tar was that the material had to be warmed before it would allow of the tar penetrating its pores. The more it was warmed, the more the tar penetrated. While this warming process was being carried out, however, the fact of making the slag very hot also made it very brittle; and thus, while making it a suitable material for footpaths and light wear, it made it a most unsuitable material for roads.

Mr. J. Walker Smith, of Barrow-in-Furness, agreed with the previous speaker and with Mr. Wike that tar macadam, in some form or other, was the road-construction material of the future. So satisfied had he made himself upon this point, that at Barrow they had recently amended their standard of classification for the construction of streets; and no street would be made with other material than tar macadam. They had arrived at this conclusion after many mistakes and failures; and he thought they had now managed to make a tar macadam which, if not capable of bearing the heaviest traffic, was certainly standing very considerable traffic from motor-cars and motor-waggons. Mr. A. J. Pryce, of Lytham, thought there could be no question as to the road of the future being a tar-macadamized one. On sanitary and economic grounds, as well as for vehicular traffic, it would make almost an ideal road. The success of a tarred road would depend upon the way in which the tar was boiled. Alderman A. G. Turley, of West Bromwich, said they had tried tar macadam about twelve months ago. They got their Surveyor (Mr. Greatorex) to experiment upon the High Street, which was one of the hardest-worked roads in the district. He put on 4 inches of slag and tar—two coats, which had been down for twelve months, and it had certainly stood exceedingly well. Mr. J. S. Brodie, of Blackpool, said he had made tar-macadam roads for the last twenty years. He would not say that all had given him satisfaction, but the cause had generally been careless workmen or defective material, or something quite apart from the principle of mixing slag or limestone with tar for securing a good impervious road.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read the third time and passed: Bude Gas Bill; King's Norton and Northfield Urban District Council Bill; Penrith Urban District Council Bill; Worthing Gas Bill.

An appeal in the case of *Cleverley and Others v. Gaslight and Coke Company*, which was before the Court of Appeal on the 10th ult., as recorded in the "JOURNAL" for June 18 (p. 825), was presented last Thursday; and the respondents—the Company—were ordered to lodge a printed case in answer thereto on or before the 29th prox. A petition of the appellants for leave to prosecute their appeal *in forma pauperis* was read and referred to the Appeal Committee.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read a second time and committed: Broadstairs and St. Peter's Urban District Water Bill; Portishead District Water Bill.

Lords Bills reported, with amendments: Renfrewshire Upper District (Eastwood and Mearns) Water Bill, Selsey Water Bill.

Lords Bill read the third time and passed: Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water-Works Bill; Great Yarmouth Water-Works and Lowestoft Water and Gas Bill; Tees Valley Water (Consolidation) Bill.

HERTS AND ESSEX WATER ORDER.

Nazeing Parish Council's Consent Dispensed With.

In compliance with the provisions of the Gas and Water Works Facilities Act, 1870, the Board of Trade have reported to the House of Commons that, in making the Herts and Essex Water Provisional Order, they have dispensed with the consent of the Nazeing Parish Council, who are the Local Authority for a portion of the district included in the limits of the Order. The application for the Order was made by the Herts and Essex Water-Works Company, Limited, and was for power to extend their authorized limits of supply so as to include the parishes of Roydon, Great Parndon, Little Parndon, and Nazeing, in the county of Essex, and to raise additional capital. All the necessary consents were obtained, with the exception of that of the Nazeing Parish Council; and the promoters asked the Board of Trade to exercise their powers and dispense with it. The Board accordingly held an inquiry, and invited representatives of the Council to be present. The Chairman attended, and stated that he thought the Council would have no objection to the Order provided that it would not involve any charge upon the rates, and that there was no compulsion to take water from the Company. In these circumstances, and in view of the fact that the consent of the Epping Rural District Council, in whose district the parish of Nazeing is situated, had been obtained, it did not appear to the Board that there was any ground for refusing to grant the promoters the powers asked for, as regards the parish in question. They therefore decided to dispense with the consent of the Parish Council and grant the Order.

Automatic Machines and the Bronze Coinage.

According to the annual report of the Deputy-Master of the Mint, issued last Wednesday, one of the curious facts of the year was the excessive demand for bronze coin, especially pennies; and he has endeavoured to discover the reason for this. He finds that the demand is chiefly due to the rapid development of automatic machines operated by pence. A series of inquiries he made among companies and local authorities who supply gas and electricity on the "penny-in-the-slot" system, companies who provide sweetmeats, matches, and other things from automatic machines, railway companies, and others, leads him to the remarkable conclusion that upwards of 60 million pennies, valued at £250,000, are continuously locked up in these machines, and consequently permanently withdrawn from circulation. "The effect of this on the recent demand for bronze coins can be realized," adds the Deputy-Master, "when it is remembered that this amount exceeds the total issue of pence for the three years 1903-5."

Birmingham Gas-Fitters' Association.—In reviewing, at the third annual general meeting, the work done by the Birmingham Gas-Fitters' Association during the past year, the Chairman (Mr. John Thacker) said their main efforts had been to put a stop to the evil of direct trading; and great headway had been made. Six firms had been approached, and satisfactory arrangements made that where this direct trading was indispensable a commission should be reserved for the local gas-fitter. The Committee had interviewed Mr. Hampton Barber, the Secretary to the Corporation Gas Department, and obtained revised prices in connection with fixing services, which would be of benefit to members. They had also arranged that a certain number of members of the Association in different parts of the area of supply should act as agents and display cookers as supplied by the Gas Department; and the Committee felt that this was a very valuable concession. Mr. Wiltshire said he thought the number of members to exhibit these cookers should not be limited, but should include all who had applied, and who had suitable premises.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Workmen's Compensation Statistics at Sheffield.

Sir,—I notice that at the recent meeting of the Institution of Gas Engineers a resolution was passed requesting the Council to appoint a Committee to consider the question of insurance under the various Workmen's Compensation Acts; and I have thought that possibly the experience of this Company may be of some interest to your readers. When the first Act came into operation in July, 1898, a report was presented to my Directors showing the number of accidents that had occurred during the previous two years; and from the statistics then compiled, they decided to set aside a sum equal to 6s. 8d. per cent. on the total wages paid by the Company.

The following table gives the number of accidents that have been paid for, the amount set aside by the Company, the sum paid in compensation, and the balance in hand at the end of each year commencing December, 1898, and also what extra compensation would have been paid had the 1897 Act contained the same provisions as the new Act.

It will be seen that, after the settlement of all claims, there was a balance in hand of £709, but that under the new Act this balance would only have been £223, which would have been a very small sum to have accumulated after 8½ years' working, and would not be sufficient provision for any serious accident that might result in the death of several men. My Board have therefore decided to increase from the 1st inst. the sum set aside from 6s. 8d. to 8s. per cent. on the amount of wages paid. This additional 1s. 4d. per cent. would have amounted, on the 8½ years that the Act has been in force, to £502, which, added to the balance we should have had in hand had the provisions of the new Act applied during that period, would have left us with £725—very much the same as we have actually accumulated under the 1897 Act.

In getting out the particulars for the above table, some very interesting points have come under notice. For instance, it has been found—certainly contrary to what I and probably most people would have expected—that the accidents due to machinery have been extremely small. Only 22 such cases have occurred during the 8½ years; and the sum

Workmen's Compensation Act.—Company's Fund Started July, 1898.

Year.	Number of Men.	Total Wages Paid.	Number of Accidents causing Absence of over 14 Days.		Amount Set Aside for Compensation, being 6s. 8d. per cent. of Wages Paid.	Amount Paid in Compensation.	Balance Dec. 31 each Year.	Number of Accidents causing Absence of over 7 Days.		Under 1906 Act.		—
			Total.	Per Cent.				Total.	Per Cent.	Compensation would have Amounted to	Leaving Balance of	
		£			£	£	£			£	£	
1898	1159	41,953	6	0·51	139	15	124	12	1·03	35	104	6 months only.
1899	1273	89,702	8	0·62	299	125	298	21	1·65	265	138	
1900	1255	97,222	25	1·99	324	525	96	40	3·18	580	£118	*deficit.**
1901	1327	98,950	19	1·43	330	114	312	33	2·48	165	47	
1902	1220	91,153	15	1·23	304	266	349	32	2·62	328	23	
1903	1151	85,311	13	1·13	284	108	525	22	1·91	148	159	
1904	1103	83,760	17	1·54	279	250	554	32	2·90	289	149	
1905	1097	82,036	18	1·64	273	339	488	34	3·10	377	45	
1906	1129	83,134	21	1·86	277	56	709	31	2·74	99	223	
		£753,221			£2509	£1798 Or 4s. 9·29d. per cent. on wages.				£2286 Or 6s. 0·84d. per cent. on wages.		

* Two fatal accidents occurred in this year.

paid in compensation for machinery accidents has only amounted to £97 12s. 5d., or 5·43 per cent. of the total paid for all kinds of accidents. Then, again, it might be thought that at our new works at Grimesthorpe, where there was more ample space allowed for the men to move about, there would have been fewer accidents than at the older works. But this has not been so. It will be observed that the percentage of accidents at Grimesthorpe was greater than at either of the other stations.

Accidents for 8½ years from July 1, 1898, to Dec. 31, 1906.

	Average number of men employed.	Average number of accidents per annum.	Percentage on number of men employed.
Neepsend	476	15·41	3·27
Grimesthorpe	270	12·94	4·79
Effingham Street	155	4·71	3·03
Street men, fitting department, meter and stove repairers, &c.	287	3·88	1·35
	1188	36·94	3·11

The following list shows the ages of men to whom accidents have occurred; and this bears out a statement made by Sir George Livesey some time back that the larger proportion of accidents happen to the younger men, and that men as they get older become more careful and steady at their work.

Age.	Total number of accidents including trivial accidents for which no compensation was payable.	Percentage at each age.
Under 20	27	8·60
,, 30	98	31·21
,, 40	81	25·80
,, 50	62	19·74
,, 60	39	12·42
Over 60	7	2·23
	314	100·00

I am aware that these particulars would be more valuable if I were able to give the ages of all the men in our employ; but I feel sure that my Company have as large a number of old servants as most other gas undertakings.

Sheffield United Gaslight Company, July 18, 1907. Hanbury Thomas.

Capital Expenditure of Gas Companies and Local Authorities

Sir,—The letter from me which you were so good as to publish last week was by no means intended to be a categorical answer to your observations, which I only cursorily glanced at—so cursorily, in fact, as to miss the question which you have repeated in your foot-note. Let me say at once in reply to this that I consider my comparisons to be absolutely fair, or I would not have employed them. They show that which has been apparent for years—namely, that the local authorities are reducing their capital indebtedness per million cubic feet sold at a much greater rate than are the companies; and it is idle to ignore so patent a fact.

With regard to your demand for a further comparison, I am almost tempted to observe that, if you regard not the figures already given, neither will you be persuaded though others be supplied to you. As it happens, however, I did make such a comparison, although not based upon the method of selection which you suggest. My method was to take all the companies, numbering about 316, which are to be found in both the 1882 and the 1905 returns, and deduct the amount added for conversions, as recorded in the latest return. The result shows that the average capital outlay of these companies has been reduced from £731 to £599 per million cubic feet sold, which compares with the reduction during the same period by the local authorities from £712 to £401. Stated in another way, an increased consumption of 54½ thousand million cubic feet has involved an additional capital expenditure by these companies of 27¼ millions sterling, which is at the rate of £499 per million cubic feet sold, as compared with the additional indebtedness incurred by local authorities of only £188. I do not, of course, pledge myself to the absolute accuracy of these figures; but as to their substantial accuracy I have no reason to doubt.

There is but little difference in size between the two classes of undertakings which are thus compared, if measured by average consumption; but it may be observed incidentally that the later returns show the increase of consumption to have been the greatest with the undertakings owned by local authorities.

15, *Victoria Street, S.W., July 18, 1907.* Chas. Hunt.

[It is to be hoped that Mr. Hunt is not continuing to give a mere "cursory glance" at what is said on this subject. But a little suspicion is entertained on the point, inasmuch as otherwise we do not think he would impute to us a disregard for the figures he has published. Those figures were fully understood by us. Our point applies not to the figures, but to the explanation; the complaint being that such figures were employed without *a full explanation* of the variations of condition that result in their widening as between companies and local authorities, apart from the conversion of capital by companies. We quite appreciate that Mr. Hunt would find it a tiresome undertaking to institute a comparison such as that we suggested last week; but it is the only fair way to compare like with like—that is to say (to put the point in fuller form than last week) a fair comparison with the 148 local authorities can only be made by taking 148 companies of approximately equal capacity and opportunity (eliminating the four London ones of 1882 and the three of to-day, and allowing for the conversion of capital); then showing what has happened in connection with those approximately comparable concerns. This process of selection would eliminate no less than 200 companies (excluding the London companies) whose capacity and opportunity are not comparable with the majority of the 148 local authorities, and whose inclusion in the comparison does not assist to make it look better from the companies' standpoint. If Mr. Hunt will compile such a comparison, we shall be pleased to publish it in full detail—both the 1882 and the 1905 figures—and show the result. Reserving to ourselves the right of judging of the selection made, we promise Mr. Hunt that we will be "persuaded" by the lessons that will

be produced as the result. Mr. Hunt says "there is but little difference between the two classes of undertakings which are thus compared, *if measured by the average consumption*." The italics are ours. Mr. Hunt is presumably trying to gain a point here by throwing the great weight of the London Gas Companies into the scale with all the little and highly capitalized companies per million cubic feet. Let us deduct the four London Companies of 1882 from the returns relating the 352 companies, and see whether the 348 remaining are equal in capacity and opportunity to the 148 local authority undertakings. Take coal first.

Coal Carbonized in 1882 *by Companies and Local Authorities.*

	Tons.
Total for 352 Companies	4,928,695
Deduct four London Companies (Field) .	2,054,409
Total for 348 Companies	2,874,286
Total for 148 Local Authorities	2,352,062
200 Companies	522,224

Therefore if 148 companies could be taken, carbonizing approximately the same quantity of coal as the 148 local authorities (2,352,062 tons), we have only 522,244 tons to distribute among the remaining 200 companies. And it is Mr. Hunt who, defending his figures as to capital per million, says there is "little difference in size between the two classes of undertakings," if measured by average consumption!

Consumption of Gas in 1882 *by Companies and Local Authorities.*

	Cubic Feet Thousands.
Total for 352 Companies	45,484,910
Deduct four London Companies (Field) . .	19,648,424
Total for 348 Companies	25,836,486
Total for 148 Local Authorities	21,129,034
200 Companies	4,707,452

The figures show that if 148 companies could be found with consumptions approximate to those of the 148 local authorities, then we have only 4,707,452 thousand cubic feet to distribute among the remaining 200 companies. It is Mr. Hunt who says there is "little difference between the two classes of undertakings!" Unfortunately, our file of returns is not complete for the earlier years of issue. But we find that in 1888 (deducting the three London Gas Companies) 392 companies had 10,763 miles of mains and 173 local authorities 7508 miles; but the 392 companies only had 807,667 consumers, the local authorities 1,089,748—that is to say, the 173 local authorities had 282,081 more consumers on 3255 miles less of mains than the 392 gas companies. This shows the great difference in the character of the districts supplied in favour of the local authorities. And all these points bear on the full explanation that we ask Mr. Hunt to make when such figures as those that he has recently been publicly using are produced.

Some Figures for 1905, *Excluding the London Companies.*

479 companies, coal carbonized	5,047,376 tons
270 local authorities, ,, ...	5,758,180 ,,
479 companies, gas consumption	64,700,766,000 cub. ft.
270 local authorities ,, ...	60,559,280,000 ,,

Does Mr. Hunt still say that there is but little difference in size (we would add, and condition) between the two classes of undertaking, when 479 companies are only doing about the same amount of business as 270 local authority undertakings? We repeat our claim that, when capital figures as produced by Mr. Hunt are used, particularly before men who are not gas experts, explanation should in fairness be made of the conditions that contribute to the large difference per million cubic feet of gas sold.—Ed. J.G.L.]

Distribution of Gas at Increased Pressure.

Sir,—What do these advocates of high-pressure mean? Mr. Carpenter's letter in this week's "Journal" is inexplicable. I understood him to say that he keeps the full pressure on during the twenty-four hours of every day; and yet he now states that he finds the greatest pressure necessary to be given throughout the week is on Sunday morning, and adds: "I think of this on winter Sundays, when I patiently (and shiveringly) wait until nightfall for the works to put the pressure on." Are we to understand now that at his works the pressure is taken off altogether on Sundays, and that Mr. Carpenter cannot even light his gas-stove till nightfall? Mr. Newbigging's "Golden Rule" neither advocates nor indirectly implies any such practice as that.

July 17, 1907. Student.

The Directors of the Walker and Wallsend Gas Company have declared the following interim dividends upon their stocks for the half year ended June 30: Upon the preference stock, at the rate of 5 per cent. per annum, less income-tax; upon the 3½ per cent. consolidated stock, at the rate of 4⅞ per cent. per annum; and upon the 5 per cent. ordinary stock, at the rate of 6⅝ per cent. per annum, less income-tax.

Rules for the Guidance of Workmen Employed in the Chief Inspector's Department of the Gaslight and Coke Company.

Sir,—At the recent meeting of the Institution of Gas Engineers, mention having been made of the rules which this Company issue to their fitters and other men employed in the Inspectors' Department, Mr. J. H. Brearley asked me whether the Company would publish those rules for the use of other undertakings that have not already their own printed rules, and might be desirous of drawing up a set applicable to their circumstances.

As this was followed by several requests from different quarters for copies of the rules in question, I referred the matter to the Governor of the Company. Mr. Corbet Woodall at once said that, if our rules were of any interest, or could be of assistance, to any of his colleagues in the gas industry, he was only too pleased for them to be published—only asking, in return, that if anyone should have any comments or suggestions to make concerning any of the rules, he should give the Company the benefit of his opinion and experience.

I accordingly have pleasure in enclosing a copy of the rules in question, and shall be glad if you will find space in your columns for them.

F. W. Goodenough.

Gaslight and Coke Company, Inspectors' Department, Horseferry Road, S.W., July 19, 1907.

[Enclosure.]

RULES FOR GUIDANCE OF WORKMEN EMPLOYED IN CHIEF INSPECTOR'S DEPARTMENT OF GASLIGHT & COKE COMPANY.

Special Note.

These rules should be read through, carefully noted, and kept for future reference by every workman in the department, as some instructions apply to all the men, while those which deal with any of the special branches of the department's work—such as stove-fixing, maintenance, and meter-reading—may at any time be of assistance to, and have to be carried out by, men not usually engaged on that particular work.

It is impossible for any book of rules to deal with every detail of every man's daily work; and these rules must be taken as dealing only with points to which it is deemed advisable specially to call attention. The omission of any express instruction to do, or not to do, anything which a workman having a reasonable knowledge of his trade, and possessing ordinary intelligence and commonsense, would do or would avoid doing, cannot be accepted as any excuse for failure on the part of any man to do his work in a proper and workmanlike manner, and to exercise foresight and judgment in the performance of his duty.

Ignorance of the following rules will not be accepted in any case as an excuse for failure to carry out any of those rules, which must be produced by every workman whenever an examination is made of his kit or at any other time if called upon to do so. The charge for a copy to replace one lost will be one shilling.

I have duly noted the above.

Signature of Workman.....

Date.....

Suggestions.

"Suggestion-boxes" are placed at every office; and suggestions towards improving the Company's system of working, or in respect of any matter which concerns the interests of the Company, are invited, and will be welcomed from any of the Company's employees. Intelligent criticism of existing methods, accompanied by proposals for their amendment—even if they are not accepted by those having, perhaps, fuller knowledge of the circumstances which govern the system of working—will be regarded as evidence of a man's ability and zeal.

Outdoor Workmen's Provident Society.

All workmen are eligible to become members of the Provident Society, provided they are certified as in good health by the Club Doctor, and are not over the age of 35 years. Every workman is strongly recommended to become a member; and a book containing all information and rules will be furnished to any man applying for the same at the office. The Company subscribe liberally to the Provident Society; and the allowance made to a workman injured in their employment is greater in the case of members than in that of non-members of the Society.

Rules.

I.—*General Conduct.*

Every servant of the Company shall conduct himself in a quiet and orderly manner at all times, be willing and obliging towards the Company's consumers, and adopt an invariable rule of courteously addressing all consumers, whether rich or poor, and so endeavouring to gain their appreciation.

Every man who respects himself will work for his employer as carefully, expeditiously, and economically as he would for himself. Every fitter is expected to see that his mate does a good day's work for his pay, and shows intelligence and willingness in the execution of his duty, and is expected to report faithfully to the foreman from time to time as to the value of such workman to the Company.

The Company subscribe liberally to their men's Provident Societies, give a week's holiday annually on full pay to permanent hands, and make good provision for their men when they are too old to work. They look, in return, for a conscientious regard for, and a zealous furtherance of, their interests on the part of all their employees.

Let every man realize—as, happily, most of the Company's men do realize—that the Company's prosperity depends upon the thorough satisfaction of their consumers, and that his prosperity depends on that of the Company. Men who do not realize and act upon these facts are not wanted. Men who do, will find the Company a good friend.

Promotion will always depend upon proved industry and steadiness, combined with ability and fitness for the service. Long service by itself does not entitle a man to promotion. Other things being equal,

the longer-service man will be preferred; but no man need expect advancement who has not made a real and persistent effort to fit himself for a higher position.

Every man should, by carefully studying the Company's pamphlets and other advertising matter—to be obtained in all the show-rooms—keep himself posted in all the arguments in favour of the use of gas for all purposes, so as to be able to answer questions put by consumers or intending consumers, and to take every opportunity of forwarding the Company's interests.

II.—*General Appearance, Cleanliness, &c.*

Every man must pay regard to his general appearance, and attend regularly and punctually at the office each morning with clean boots, and dressed in clothing suitable for his work and position, and endeavour to keep himself always smart, tidy, and clean. Observations are taken in this direction by the inspectors and chief officers, and are borne in mind when applications are received for increases in wages, or when selections are made for promotions to the staff.

III.—*Sobriety.*

The practice of drinking intoxicating liquors while on duty is strictly forbidden, and no man is allowed to enter (except on Company's business) or to loiter in public houses during the hours of employment. When engaged in work upon licensed premises, workmen should carefully avoid temptation to drink. Any complaints from consumers, or detection by the officers, of men being under the influence of drink on duty will be dealt with most severely.

IV.—*Smoking.*

Smoking is also strictly prohibited upon the Company's premises at any time, or on the districts while on duty.

V.—*Change of Address.*

Every workman must immediately notify the office of any change in his address.

VI.—*Absence through Illness, &c.*

When a workman is unable to attend to his duties through illness or any other cause, advice must be sent immediately to the office. If the absence extends beyond one day, a doctor's certificate must be forwarded.

VII.—*Caps.*

Every out-door workman is provided with an official numbered cap, which he is required to wear whenever on the Company's business. No man is permitted to begin work on any day unless he is wearing his official cap; and any man losing his cap will be suspended until it is found or the fact of its destruction proved to the satisfaction of the Chief Inspector. A new cap is provided for each man annually, in exchange for the old cap, which must be returned to stores in every case. Every man leaving the Company's service is required to give up his cap before he is paid the last amount of wages due to him.

VIII.—*Tools.*

Every workman is responsible to the Company for all tools, &c., entrusted to him, and is required to pay for the replacement of any tools missing whenever an examination is made of his kit. The value of any tools missing when a man leaves the service will be deducted from any wages due to him.

Pawning, or attempting to pawn, the Company's tools, renders the offender liable to prosecution as well as to summary dismissal.

IX.—*Escapes of Gas.*

Every man is required to display the utmost promptitude and activity in dealing with escapes of gas. Escapes must at all times take precedence over every other job; and any man failing to give immediate and adequate attention to escapes will render himself liable to summary dismissal.

Whenever a serious escape is suspected, all lights or fires in the vicinity must be immediately extinguished, the doors and windows of the premises thrown open, everyone on the premises warned against striking lights, and bystanders warned against smoking or using matches—the aid of the police being invoked, if necessary, to enforce this warning and to keep people away from the premises. Those summoned to attend to escapes must exercise their judgment as to whether all or any of these precautions should be observed; but care should always be taken to err rather on the side of caution than on the side of "chancing it," or under-estimating the possible danger.

Familiarity with the use and smell of gas should not be allowed to breed contempt in the minds of fitters for the risks attending its escape or misuse. Gas, like fire or electricity, is a dangerous thing out of its proper place, and those accustomed to dealing with it must never forget the fact, or neglect any proper precaution against accident.¶

The Mains Department must be immediately communicated with when an escape is found or suspected to be coming from a main or service, or it is desirable to get the supply to any premises disconnected from without; the consumer being informed that it is necessary to summon the service-layers, and that the matter will receive the promptest possible attention.

It is the duty of everyone in this department at all times to co-operate in the fullest possible manner with the Mains Department in dealing with escapes, fires, or other emergencies connected with the supply.

In cases where gas has been, or is believed to have been, escaping, and it is possible that it may by any means have got behind a lath-and-plaster partition, under a floor, or anywhere whence it has no means of passing off to the free air, a light must not be used on any account, either for locating the escape (however trivial it may be thought to have been), or for trying work after the escape has been discovered and remedied, as gas has been known to remain inside partitions, &c., and to be fired by a light a long time after the escape has been stopped. In all such cases the fitter must rely on carefully smelling around the suspected part, in conjunction with the meter test—first making sure that the meter is sensitive enough to register a very small quantity of gas, and exchanging it if it is not. (*See* Rule XXXIII.)

No man should enter premises filled with gas without having first provided the means of getting out or being got out again quickly in case of need. This is best done by the man entering fastening to himself a rope, the end of which is retained by someone remaining outside, who should see that the man inside continues to signal to him from time to time in a pre-arranged manner. The neglect to take this precaution may at any time lead to fatal consequences.

Permission should be obtained from some responsible person before floor-boards are raised, or the structural portion of the premises is interfered with, in searching for an escape, unless, in case of urgency, no person is accessible from whom such permission can be obtained.

When searching for an escape complained of by a consumer, fitters should ascertain by examination and inquiry whether any section of the pipes is controlled by a master-tap, as, if there is an escape on such a section, it would, of course, only be noticeable if the master-tap of that section were turned on, and the escape would not show on the test dial of the meter or be detected in any other way if, when the search was in progress, the master-tap were shut off.

X.—*Using Matches or Other Naked Lights.*

Workmen must avoid the use of matches or other naked lights as far as possible; being particularly cautious should there be any smell or trace of gas or complaint of escape. Safety lamps must be used with care in such cases, and when exchanging or altering positions of large meters or working in confined spaces.

When it is thought safe to use matches or other naked lights, the greatest care must always be exercised.

When joints and fittings are about to be tried with lighted matches or tapers, the parts to be tried must be minutely examined, and the surroundings well fanned beforehand to prevent the possibility of a small collection of gas near the ceiling or in the roof of a vault, &c., being fired by the light; and afterwards a careful examination should be made for ignited escapes—the hand being placed on all parts of the joints and along the pipes with a view to detecting any small escapes that may have been ignited but only show a blue light. The whole of the pipes should then be fanned on all sides as a final precaution against the serious danger arising from the leaving of a blue flame burning.

The use of lighted rushes for joint making, &c., must be exercised with great care; no parts that may drop being left to smoulder. Spirit lamps should be used in preference to rushes. Matches must not be struck on woodwork or furniture. All ends of matches used must be brought off the premises.

XI.—*Escapes and Defects on Private Fittings.*

Any escape or defect found to proceed from consumers' fittings must be remedied or temporarily secured if it can be traced, and an explanation given to some responsible person on the premises. If the escape be of serious dimensions, and cannot be located and temporarily secured or remedied at the time, the gas should be turned off at the main cock, and an explanation given to the consumer, or some responsible person, that it is necessary to take such action for safety pending the arrival of consumer's own fitters, or further attention by the Company. All such cases should be fully and promptly reported on, in order that they may be dealt with by the Inspector.

If defects or escapes are reported by a consumer to a fitter employed upon other work, he must proceed to locate and secure permanently or temporarily (as may be possible) any escape, or to improve the supply if possible, informing the consumer as to the cause of the trouble. If an escape be found to be proceeding from the consumer's pipes which the fitter is unable to trace and remedy, the fitter must make out an "Escape" notice and deliver the same to the consumer or some responsible person on the premises, advising him to have the gas turned off if there is any reason to apprehend danger from the escape.

In the case of defects in private fittings (or in consumers' own stoves) which cannot be remedied there and then, the fitter must make out a "Defective Fittings" notice (with such alteration in wording as may be necessary in the case of defective stoves or fires), and deliver the same to the consumer, inquiring whether he will call in his own fitter or if he wishes the Company to deal with the matter right through. In the latter event, the fitter should, if possible, obtain the consumer's signature to the order form attached to the notice, and attach that order to his work-sheet. He must note and report all necessary particulars, especially drawing the attention of the foreman to the case should the consumer desire the Company to attend to the defects.

Before leaving the premises, the fitter should describe to the consumer the best means of temporarily stopping any further escape (should any be discovered), and the mode of ventilating the premises in such cases of escape.

XII.—*Working with Live Gas.**

In the event of any job involving work with live gas on services of 1 inch and upwards on the street side of the main-cock in any confined space—for example, where a connection has to be made on the service side of the meter and there is no means of shutting off the supply—an officer (or a workman specially selected for the purpose by the Inspector-in-Charge) must in all cases be present, in addition to the fitter and his mate, and any fitter commencing work on live gas contrary to this rule will be liable to summary dismissal.

This rule does not apply to the work of taking out the plug of a main-cock to ease it, of capping a service, or of examining capped services or tees.

XIII.—*Persons Suffering from Effects of Gas Poisoning.*

As long as the person affected has not lost consciousness, there is little cause for alarm; but a doctor should be summoned if the ordinary measures do not bring about prompt recovery. The sufferer should be removed immediately from the influence of the gas, be given plenty of fresh air, and, if able to move at all, be kept walking about, as the exercise helps the respiration. He (or she) should be given plenty of milk, or milk and soda, or water in which baking-soda has been dissolved (a teaspoonful to the pint). Strong salts of ammonia held under the nose will help to revive the sufferer.

If the victim has lost consciousness, a doctor must immediately be sent for, the sufferer laid on his back, with a tightly-rolled coat under the shoulders to throw the head well back, and the following pro-

* See Rule LV. as to avoiding work with live gas in case of new unvalved services.

cedure adopted until the doctor arrives, when, of course, his instructions must be carried out.

Open the clothes at the throat, chest, and abdomen. Roll up the trousers from the legs. Supply heat to the extremities, either by vigorous friction or by hot bricks, hot-water bottles, plates, &c. Pull the tongue out of the mouth, and hold it firmly to prevent it slipping back and falling into the throat. Make the victim breathe by kneeling at his head, grasping his arms at the elbows, and pressing them vigorously to his sides; then straighten the arms, pulling them back until the hands meet over the head; then return the arms to the sides and fold them across the chest, pressing them down hard. Repeat about four or five times a minute; being careful not to make the motions too rapidly. The sole object of the motions is to fill the lungs with air and empty them in imitation of natural breathing.

During the entire process of artificial respiration let others apply heat to the extremities, either by friction or by hot-water bottles, bricks, plates, &c., and slap the chest with a wet towel.

The restoration of asphyxiated persons has been accomplished at long periods after apparent death, so artificial respiration should be continued until a doctor pronounces the victim dead.

The work, to be effective, is very tiresome, and ten minutes at a stretch is about as long as one man can administer the treatment effectively. On this account, operators should be changed before their strength is spent.

When the victim begins to breathe naturally, give him a dose of aromatic spirits of ammonia—*i.e.*, sal volatile—and cover him up warmly until he can be moved.

XIV.—*Fires, Explosions, or other Accidents.*

In all cases of fires, explosions, or other accidents reported at the office, an officer should accompany the fitters (if the District Inspector be out, he must follow immediately upon receiving the report), and the greatest care and promptitude must be exercised in shutting off the supply at the main-cock (or valve outside the premises, if one exists). Where this course is not possible, the service-layers should be summoned to open the ground outside and disconnect at the main (if found necessary) or in the footway.

Should any case of fire, explosion, or other accident be brought to the notice of any workman when on the district, or he be called upon for assistance, the course above indicated must be adopted; care being taken always not to disturb unnecessarily or to remove any fittings, pending the visit of the insurance authorities. Should a fire, explosion, or other accident occur when the Company's men are at work on any premises (whether due to their work or not) the foregoing instructions must be strictly observed, and report immediately made to the office.

XV.—*Mishaps or Damage when at Work.*

Should any mishap or accident of any kind happen while the Company's men are working on premises which is a consequence of their so working—for instance, injury to ceilings, breakage of, or damage to, furniture, goods, &c., fires, or explosions—the men must do all they possibly can to repair the damage for the time being, carefully clear up, assure the consumers of immediate attention from the Company, and report at once fully to the foreman and inspector.

Should any person be injured as a result of such accident, prompt attention must be given, and if the injury be serious, a doctor must immediately be summoned, the injured person be properly cared for, and, in very serious cases, the relatives be notified.

Reports of accidents must always be made in writing, be made as soon as possible, and should contain the fullest possible particulars, including the date and precise time of the accident; the full names and addresses of any witnesses of the accident; any comments made by such witnesses; the cause of the accident, as nearly as it can be determined (care being taken to state that the cause is "surmised to be," if any doubt exists), with an explanatory sketch, if possible; the full name and address of any person injured, with nature of injury; the name and address of the doctor called in, if any; and the address to which the injured party has been taken.

Every accident which may occur in the course of a man's work, whether to himself, to property, or to other people, must be promptly and fully reported, however trivial or insignificant it may appear to be. Disregard of this rule will be very seriously regarded. A special warning may be given against the temptation to suppress or minimize any circumstances connected with the accident, as, however much the facts may reflect upon any of the men concerned, the consequences to those who may be to blame will be much less serious if those facts are promptly and frankly reported than if they are held back and are subsequently discovered. Mistakes can, but deceit cannot, be pardoned.

XVI.—*Equipment on Leaving Office.*

Before leaving the office for the day's work, every fitter must see that he is duly provided with all the tools, materials, &c., that he will require for the carrying out of the whole of his day's work, so as to avoid all chance of wasting his own time and that of his mate by having to send back during the day for missing tools, &c., causing at the same time annoyance to the consumer and damage to the Company's reputation as a business firm.

XVII.—*Appointments—Punctuality.*

Whenever an appointment is made for men to attend at a consumer's premises at a definite time, every effort must be made to keep the appointment punctually. If anything altogether unavoidable prevents the appointment being kept punctually, a message should be sent by the fitter's mate or other available messenger to the premises expressing regret for the delay and stating the time at which the men will be able to attend. Every appointment made by a workman with a consumer for his own or anyone else's attendance on a future occasion must be carefully and exactly noted in his pocket work-book and on his work-sheet.

XVIII.—*Admission to Premises.*

Every servant of the Company should guard against entering private premises without first ringing or knocking for the purpose of obtaining permission to enter, even though doors may be found open; but in regard to open business establishments, this procedure is not always necessary.

Upon obtaining admission, the workman should clearly state the object of his call, and courteously endeavor to convince the occupiers as to his *bona-fides*, if any doubt exists.

If admission cannot be obtained (in answer to a complaint or request to call), another call should be made (if possible the same day); and if with similar result, a full entry must be made in the pocket work-book and on work-sheet, for the foreman's attention during the evening; and the latter must report specially to the Inspector in case the complaint be of an urgent character. If the fitter cannot obtain admission at premises respecting which a serious complaint of escape has been received, he should return at once to the office to report.

If escaping gas is found to be coming from a vacant house, the police should be summoned with a view to an entrance being effected. No Company's workmen must ever force an entrance into closed premises, except in cases of extreme urgency.

XIX.—*Trucks Left Unattended.*

It is frequently necessary to leave trucks outside premises when the work inside necessitates the attendance of fitter and mate.

In such cases the greatest care must be exercised to avoid loss of tools,* material, stove utensils, &c., which (unless locked up in the truck box) should be, as far as possible, removed to a place of safety.

In the City, in districts where traffic is heavy, and when trucks are practically empty, it is often possible to arrange to leave trucks, for the time being, in suitable places—in mews, yards, &c.—by first obtaining the necessary permission.

XX.—*Condition and Use of Trucks.*

The greatest care must at all times be taken with trucks. They should not be taken out in a dirty condition, or in a bad state of repair. Workmen are forbidden to push trucks from the wrong end with handle uplifted, as the control over the truck is thereby considerably lessened, and a greater risk is run of colliding with other vehicles should the truck become involved in congested traffic.

Should an accident occur and injury to person or property result owing to this order being disregarded, the offender will be dealt with severely.

XXI.—*Ferocious Dogs Kept.*

Note must be made—by the fitters in pocket work-books and on work-sheets (for transfer by clerk into meter-index book), and by index-readers in meter-index books (in red ink)—where it is found that ferocious dogs are kept. Care must be taken when at work with fittings disconnected, or gas on, if such dogs are allowed to remain unchained.

XXII.—*Conversation with Servants and Others.*

All men are especially reminded that they are not to converse unnecessarily with consumers, members of the household, or servants; are not to make inquiries outside those necessary in connection with their work; and are not to make any comments, favourable or otherwise, on a consumer's gas appliances, nor to criticize to the consumer or his servants work done by other workmen.

XXIII.—*Questions from Consumers and Others, outside the Business of Fitters.*

Any questions or inquiries from consumers, which the fitters are not able—or which they do not think it advisable—to answer, being in reference to matters outside the actual business or knowledge of the fitters, should be carefully noted and reported to the foreman for the attention of the Inspector; the consumer being courteously informed that his inquiry will receive attention at the earliest possible moment.

XXIV.—*Requirements and Requests of Consumers.*

Fitters are frequently asked for utensils for stoves, and for burners, rings, tubes, &c., or receive applications for the supply of cookers, fires, fittings, lamps, &c. All such requests must be carefully and fully noted in pocket work-book, and reported on work-sheet for the attention of the foreman and Inspector. No complaints should be received by the Company of promises of attention having been made by the Company's men and not fulfilled.

XXV.—*Assistance Rendered by Consumers.*

If any man, in the course of his work, has occasion to ask an accommodation from a consumer or his servants—for example, the loan of steps, a supply of water, &c.—he should never omit to express thanks for the favour, however small.

XXVI.—*Private Work for Consumers.*

No servant of the Company is allowed to undertake work on his own account for any of the Company's consumers at any time, and no charges are to be made under any circumstances by workmen to consumers for any work executed. Any work in connection with private fittings, stoves, &c., required by consumers to be done (if not small jobs that can be done straight away—such as repacking a gas-fire—particulars of which should be duly booked) must be dealt with in the same way as "defects in private fittings," as to which see Rule XI.

XXVII.—*Attention of Consumers to be drawn to Cash or Jewellery Exposed.*

It is important that, should any workman discover any jewellery, cash, or other valuables exposed to view in any room where he is called upon to work, the attention of the consumer or his servants should at once be drawn to such valuables, and that the greatest care should be taken by the fitters and their assistants to make a complete note in the pocket work-book of any property found so exposed, with particulars stating whose attention was drawn thereto, with time and date; and if the valuables are not removed during their attendance, the course above indicated should be repeated before leaving the rooms or premises.

Strict attention to this rule is enjoined in the interests of the workmen themselves.

XXVIII.—*Abusive or Ill-Tempered Consumers.*

Occasionally the Company's workmen have to deal with consumers inclined to be unreasonable, ill-tempered, or even abusive, especially in cases of disconnection of supply for non-payment. Particular care must always be taken to show every possible courtesy and forbearance towards such consumers, and to avoid loss of temper, the display of any personal feeling, or the resentment of abuse, which, it should be remembered, only reflects upon him who resorts to its use.

* See Rule VIII.

Where it is found that a consumer has, without apparent reason, a grievance or prejudice against the Company, courtesy and discretion on the part of their servants may often discover, and secure the removal of the cause of, such grievance or prejudice. In any discussion with a consumer, speaking loudly or excitably should always be avoided. A quiet, confident, and respectful manner carries more weight than any amount of bluster, which only irritates and offends.

XXIX.—*Condition of Company's Services.*

Every employee should take every opportunity of observing the condition of the Company's services and meters, and, if defective, book and report same for attention.

Every opportunity should also be taken of making sure that gas is not being obtained without being metered. Wherever any suspicions are aroused on this point, the workman first noticing the suspicious circumstances must carefully and exactly note, and quietly bring to the notice of any other Company's men working on the premises, all details of the apparently fraudulent connection, say nothing to anyone else on the premises, and secure the presence of an officer at the earliest possible moment.

Meter-index readers must constantly bear this instruction in mind.

XXX —*Condition of Stoves and Fires in Use.—Repairs to Stoves in Situ.*

When attending premises where cooking-stoves or gas-fires are in use, fitters must note the condition of same; and, where it is seen to be needed and such a course is possible, courteously explain the proper uses of such stoves and fires and the method of using them. All defective parts must be noted, and (if on hire) booked for exchange, including the stoves themselves if beyond repair; or, in the case of private stoves, reported for attention by the foreman and Inspector.

Fitters must not, however, book hired stoves for exchange unless that course is absolutely necessary; it being far cheaper for the Company to repair stoves *in situ* than to incur the expense entailed in effecting an exchange and renovating the old stove at the works. Every stove booked for exchange by a fitter will be inspected either by an officer or by the foreman before the order for a new stove is given; and any tendency on the part of fitters to save themselves trouble by the unnecessary exchanging of stoves will be dealt with severely.

In effecting repairs to stoves and fires *in situ*, the instructions given in Rule LI. respecting the fixing of stoves and fires must be carefully observed, as far as applicable; and attention is here specially drawn to the injunction to fitters to make certain that every stove with which they have to deal is left in perfect working order in every particular. To discover and remedy one defect in a stove respecting which a complaint has been received is not sufficient; the stove must be thoroughly examined and tested to make sure that it is in good order in every other respect.

Oven-Burners Smothering Out.

When a cooking-stove is found to be suffering from the defect of "oven-burners smothering out," the following instructions must be carefully observed.

In every case the stove and the supply to the oven should first be disconnected, and the whole of the flue-pipes, if any, should be taken down and thoroughly cleared, if necessary.

All grease, &c., must be cleaned off the sides of the oven, as grease has a tendency to smoke and burn when the oven is hot, and so helps to smother the lights out.

In the case of stoves which are ventilated through a chamber between the oven and the crown-plate—which is the case with all except Davis cookers—the top of the stove must be removed, and the ventilating chamber thoroughly cleaned out.

The oven-burners must in all cases be removed and thoroughly cleared of all grease, carbon, dirt, &c., as must also the air-chamber. In refixing them, care must be taken to see that the nipples are properly adjusted to give a good bunsen flame, and that they play into the centre of the burners, as if the gas is allowed to strike the side of the burner it is liable to fire-back. Lighting the jet at the air-chamber for a moment will show at once whether the nipple is properly centred.

Care must be taken to see that the drip-tin fits properly, and that there is not a strong draught from a door or window interfering with the proper burning of the gas in the oven. (See Rule LI. as to the best way of dealing with undue draught.)

It is equally necessary to see that sufficient air enters the bottom of the stove to support combustion, and that the consumer is not using a baking-tin so large as to be practically of equal area to that of the oven. If such be found to be the case, the consumer should be politely advised to use a smaller size.

A strong spindle screwdriver is the best kind to use for taking stoves to pieces, as broad screwdrivers cannot always be turned between the fittings on the hot-plate, &c.

A cross cut is useful for starting screws.

All parts must be carefully refixed, and the stove tested and left in proper working order in every particular before any job is answered off as completed.

XXXI.—*Condition of Incandescent Burners in Use.*

When attending premises where incandescent gas-burners are in use, fitters must, as far as opportunities permit, note the condition of the mantles, &c.; and if that condition is not satisfactory, the fact must be noted and reported on the work-sheet.

XXXII.—*Obsolete and Defective Fittings, Burners, &c.*

Where it is evident that complaints of bad light are due to the use of old-fashioned, inefficient, or defective fittings and burners, or to the meter, meter fittings, or carcase pipes being too small, or badly run and connected, the facts must be courteously explained, and advice—coupled with an offer on the part of the Company to carry out any necessary work at cost price—must be given to the consumer by the fitter, who must fully report such cases for the attention of the foreman and inspector.

XXXIII.—*Shutting-off and Re-Connecting Supply: Examinations and Testing.*

When it is found necessary to shut off any supply or supplies, the fitter must first request some responsible person upon the premises to see whether all lights, stoves, or other apparatus are turned off, and to have that done if any are burning. After such person has examined the premises and stated that no gas is in use anywhere, the fitter must watch the test-dial of the meter, and then try it with one small light in use, to determine whether the meter will register at this point. Should the meter be found not to register with one burner alight, a gauge should be fixed to the first available point which is near the meter outlet. The pressure should then be noted with the main-cock on and no gas, according to information, being used. The main-cock should then be shut off and the gauge watched. If no gas is actually being consumed, and there is no escape, the pressure will remain constant at the point at which it stood when the main-cock was open; whereas if gas is being burnt or is escaping anywhere, the pressure will fall at the gauge, and the cause must be sought and dealt with at once. Where any rooms are closed, and it is uncertain if gas is on or off in such rooms, disconnection should not be made until access thereto has been obtained.

When the fitter is satisfied that all is safely shut off, he may proceed with the work of disconnection. When reconnecting, the gas should be turned on and used until the pipes are clear of any air; this course being followed by watching the test-dial finally for any leakage, and examining and testing work and fittings. Care must be taken to see that the bye-passes of any incandescent burners in use in any part of the premises are re-lighted after the supply is restored.

XXXIV.—*Using Pumps.—Ascertaining the Run of Services, &c.*

Before using a service-pump, the fitter must first find the entrance of the service into the premises, examine the run of the supplies, and the T's in the service, and note the number of meters connected to the service, or to the T's therefrom; the greatest care being exercised when using the pump not to put any charge through a service or riser with such connections unless at a point where the service enters the premises from the roadway—the charge being, of course, blown into the main—or unless, in the case of teed services or rising mains, all cocks on inlets of meters have been carefully noted and turned off. Complete examinations and testings must be made of all supplies following such operations, before leaving the premises.

When it is necessary to use a pump on a supply taken from near the dead-end of a service or small main, the fitter must request the consumers taking supplies from such service or main between its dead-end and the point at which the pump has to be used to allow him to shut off their main-cocks temporarily; warning them of the possible danger of the charge from the pump taking effect upon their fittings (and especially on watered chandeliers) if they refuse. The fitter must subsequently see that the supply is restored in all cases, and that everything is left in safe and proper order in connection with all the supplies affected.

Old piping should not be hammered to loosen scale or rust, as it is not possible to judge what harm may be done by such hammering in other directions. Tapping services to dislodge naphthalene should be done with great care, and with as little violence as possible.

XXXV.—*Handling and Fixing Meters.*

Meters contain a good deal of mechanism, and must at all times be handled carefully. They should always be kept upright, and never be jarred or bumped on the ground or banged on the bottom of a truck. They must, in fact, be regarded and treated rather as if they were clocks than as if they were merely tin boxes.

Meters must always be fixed in dry places, properly supported, set level and plumb, with no part of the case touching any metal, cement, brick or stonework, and, as far as possible, where they will not be exposed to unusual heat or to serious fluctuations in temperature, and be easy of access for reading. Lead meter-connections must never be kinked or flattened.

XXXVI.—*Leaky Meters—Temporarily Securing, and Exchanging.*

When meters are found to be leaky, the usual and recognized means must be adopted for temporarily stopping the escape of gas, if possible; but the exchange of the meter must in all cases promptly follow. Where the leakage is such that it cannot be safely secured temporarily, the gas should be shut off and a new meter or temporary connection obtained and fixed at once; explanation and warning being clearly given to the consumer to avoid any accident by the use of lights near to the meter in the meantime.

Whenever meters are found to be leaking, care should be taken to note whether there are any local conditions likely to have caused, and to continue to cause, damage to a meter, such as leakage of acid from batteries, of current from wires, &c.; and any such harmful conditions should be reported immediately, so that steps may be taken by the inspector to get the position of the meter changed or the cause of damage removed.

XXXVII.—*Exchanging Meters.*

When exchanging meters at places of worship, halls, clubs, hotels, or large business houses (especially where the meter-fittings are complicated or governors are in use), it is necessary that the connections and supplies generally should be examined before dusk on the day on which the work has been done, to make sure that everything is in proper order before lighting-up time.

The foremen, in conjunction with the inspectors, must pay special attention to this rule, and make personal examinations in the cases referred to whenever possible—arranging for the examination to be made by their deputies if prevented by other important and urgent business from attending themselves.

XXXVIII.—*Liquor from Meters or Fittings Disconnected.*

All possible care must be taken, when exchanging meters or disconnecting pipes, to avoid the dropping of any gas liquor; and should it so happen that any be spilt, the attention of the consumers should at once be drawn to the fact—the fitter washing the parts affected, and procuring a disinfectant if possible. No liquor may be poured down drains, inside or outside premises.

XXXIX.—*Total Failure of Supply.—Temporary Connections.*

Where it is found that a meter has ceased to pass gas, a new meter must be obtained at once and fixed. In the event of no meter of the right size being in stock, and in the case of night complaints of this character, temporary connections may be fixed; and fitters attending

to such night defects should request the night watchman or inspector on night duty to refer to the meter-index book, so that they may obtain the proper sized connection before going to the job. Many letters or messages of complaint give information pointing to the probability of a meter having failed, when they state "Gas has suddenly failed," or "Gas has gone out," &c.; and this should be a guidance to those attending, either to take a new meter or a temporary connection. All cases of failure of supply should have the very promptest attention in the manner above described.

Fitters are forbidden to shake stopped meters, or in any other way endeavour to make them pass gas again.

XL.—*Meter-Index Reading—Marking Cards.*

Meter-indices should always be read a second time and deductions made carefully; the entries and deductions on the cards and in the meter-books being made independently and then compared. All entries must be made in ink; no erasures are permitted, either in meter-books or on cards; and if cards are not obtainable, entries must be made on query sheets provided for this purpose inside the meter-index books, under the headings of "Card not marked," "New card required," or "New card left," as the case may be.

Meter-readers must always carry a supply of cards, to assist them in this work, and save time and journeys, but must not leave a new card unless the consumer states that the card has been lost and not merely mislaid.

XLI.—*Fluctuations in Consumption: Questioning Servants and Others.*

When the recorded consumption is small, as compared with the corresponding quarterly, monthly, or weekly reading, it is necessary to ascertain the reasons as accurately as possible. The cause of decrease may be obvious from alterations made, stoves or engines removed, &c.; and it must be borne in mind that direct questioning of servants and others must be avoided if possible. But by the exercise of care, courtesy, and discretion, reliable and useful information may often be obtained, and should be recorded in full on the query sheets attached to meter-index books.

When the consumption has increased, the greatest care should, likewise, be taken in reading and examining the index a second or third time. There may be good reasons shown in the meter-index books for such increases—viz, additional lights, additional or larger stoves, &c. The asking of questions should be avoided; but care must be taken to see that the consumptions are correctly recorded. In case of very extraordinary increases in consumption, for which no apparent reason can be discovered, the case should be noted and specially reported to the Inspector, who will then make further examination and inquiry.

XLII.—*Testing Meter for Unregistered Gas.*

When the consumption is found to be very small, or considerably decreased without good and obvious reasons, the meter-reader should courteously ask for all lights to be turned out, if gas is in use—always provided it is convenient then to the consumer. The test-dial should then be watched with one burner lighted, to see whether the meter has stopped registering or is passing a percentage of unregistered gas, and the result should be entered on the query sheet or in the query book, giving the folio of the meter-index book, thus: "Folio 168: Will not register with one light," or "Registers with one light," as the case may be.

XLIII.—*Noting Electric Light in Use, Gas-Engines, &c.*

Care must be taken by index-takers to see that, in all cases where electric light is in use, a note of the fact appears in the meter-index books. Gas-engines in use must also be noted, and, if not already entered in the meter-book, particulars of maker and size (B.H.P.) must be reported on the query sheet.

XLIV.—*Cutting-Off and Change of Tenancy States.*

Fitters sent to disconnect a meter or to record a change of tenancy index must carefully mark the card, and, whenever possible, obtain the new address of the outgoing tenant, entering the same in the pocket work-book and on the work sheet.

If the supply is capped, the proper label must be attached to the capped service; and the inlet of the meter (and the outlet in case of complete disconnection) must be corked.

If gas should be required by the incoming tenant, the fitter should defer disconnecting and report full particulars for the Inspector's attention.

XLV.—*Meters and Stoves not to be Removed if Premises are to be Shortly Occupied.*

To save unnecessary trouble and expense, full inquiries should be made by fitters sent to cut off and remove meters and stoves, who should note the condition of same, and ascertain, as far as possible, to whom the premises are let and the probable date of the new tenant taking possession. If there be any reason to expect that the gas will be required again within a reasonable time, the meters and stoves should be left, and a report made at once for the Inspector's attention.

XLVI.—*Private Fittings not to be Removed from Premises.*

No private fittings—such as, in the case of ordinary supplies, main-cocks, unions, lead pipes, brackets, pendants, burners, &c.—are to be removed; and a note must be made in the pocket work-book and on the work sheet, at the time of removing meters, that all fittings have been left upon the premises. Stove-fittings (ordinary), including base-stones, belong to the consumer, being either supplied and fixed by private fitters or, if fixed by the Company, paid for by the consumer.

XLVII.—*Care in Cutting Away: Avoiding Damage to Property.*

When fixing cookers, fires, lamps, fittings, &c., the greatest care must be taken not to do any more cutting away than is absolutely necessary, and all must be carefully and properly made good, or booked for further attention if required. All possible care must be taken when carrying out fixing work to ensure neatness, cleanliness, and safety in working; any soiling of carpets, furniture, wall-paper, ceilings, walls, &c., by dirty boots, grease, oil, use of tools, or other means, being carefully avoided. Covers for floors, furniture, &c., can, and should always, be obtained from consumers by a courteous request. In cases where it is necessary to work on parquet or other polished-wood flooring, the fitters during all the time they are at work should wear felt slippers, which are provided for the purpose by the Company.

XLVIII.—*Fixing Vices on Woodwork, Furniture, &c.*

Vices must not be made fast to furniture or woodwork of premises, except in cases where no appreciable damage would be caused, and then only with the express permission of the consumer. Whenever a truck is available, it must be used when cutting and screwing barrel, &c.

XLIX.—*At Work with Flooring Up.*

When it is necessary to take up flooring, all care must be taken in replacing and securing the boards temporarily (or properly guarding the opening) if the job has to be left, and the attention of occupiers must be drawn to the circumstances. No carpet, linoleum, or other floorcloth should be left turned back in such a way that it may fall and cover an opening. No opening must be left unprotected at any time, whether work be in progress or otherwise; and flooring should be replaced (screws being always used and fillets put on the sides of the joists for the boards to rest on), and everything made good and secure, as quickly as possible.

L.—*Fixing Outside Lamps.*

Outside lamps must be carefally secured by safety chains or clips, and must only be fixed at heights allowed by the local authorities. Fitters must see they are provided with the necessary information as to the required height above pavement level before commencing the work. Special care must be exercised to avoid any accident or damage to facias, plate-glass windows, &c., during the execution of this class of work. Brackets for outside lamps should, whenever possible, be fixed firmly on to the building, not to blind-cases or other insecure hold. All cups-and-balls, sockets, connections, &c., should, wherever practicable, be kept fixed in position by set-screws.

LI.—*Fixing Stoves.*

Every fitter must regard it as of the utmost importance to see that every gas-stove fixed is fitted in the neatest and most workmanlike manner, causing—in the case of gas-fires—the least possible disfigurement of the fire-place, and having careful regard to the style and ornamentation of that fire-place and its surroundings. The supply to every fire should be as unobtrusive in appearance as possible.

Every fitter must also regard it as his bounden duty to see that every stove is left in perfect working order, so that he can feel sure that the stove, if properly used, will not only give rise to no complaints, but will always give the best possible result. It must be borne in mind that very many consumers do not know the full possibilities of a suitable gas-fire well-fixed, and would therefore, in the event of a fire not working in every way successfully, regard the result as the best obtainable, and look upon gas-fires as not altogether satisfactory—in ignorance of the fact that if a more suitable stove had been fixed, or if the one selected had been more carefully fitted, they would have obtained far more satisfactory results.

If, after doing everything he can to get a stove to work to his complete satisfaction, the fitter is still not satisfied, he should at once report the fact to his foreman, so that the trouble may be carefully investigated and put right—by the exchange of the stove, by taking special measures to overcome down-draught, or by whatever means may be found necessary. It must never be a case of "I think that will do"—it must always be "I am sure that is all right."

Special attention must be given to the following points in carrying out the work of fixing:—

Heating Stoves with Flue-Pipes.—(1) Every stove must, if possible, be fitted with elbow and length of flue-pipe, which must be tested to make sure that it is in sound condition, and be carefully fitted, so that all fumes are carried up the chimney. Wherever possible, the flue-pipe should reach beyond the register of the grate. This acts as a safeguard against the register falling and preventing fumes from passing up the chimney. In any case where a length of flue-pipe cannot be used, the fitters should see that the register of the grate is securely opened. All flue-outlets should be drilled and a set-screw used, wherever possible, to fasten the flue-pipe to the outlet.

(2) Before fixing any stove, it is necessary thoroughly to test the draught in the chimney by means of a lighted taper. Should the up-draught be too great, a false register must be fitted, or the grate opening be closed by sheet iron—in each case with a flue-pipe passed through it—and the size of the flue-pipe reduced and a cone fixed on it to check the up-draught.

(3) Should a down-draught exist, or be feared, a Barker's eduction valve should be fitted on the flue-pipe of the same diameter, and a false register fixed as before. The fixing of a sheet-iron cap over the chimney pot with a length of flue-pipe running through the cap—projecting 2 feet into the chimney and 2 feet above the cap, with a cone fitted on the top, may be found necessary and sufficient in the case of a severe down-draught, or a sluggish chimney. Further, the consumer should be informed that, should the steps taken not prove sufficient to remedy the down-draught, a reliable cowl must be fixed on the chimney. This information should, however, be conveyed to the consumer by the Inspector, who should be informed, through the foreman, of every case in which any difficulty arises in getting stoves to work satisfactorily.

(4) If the draught be sluggish so that the whole of the fumes are not properly carried up the chimney (which should be tested by holding a lighted taper at the top of the fire-opening of the stove, with a view to seeing whether any gases issue from the top of the fire-opening instead of the flame of the taper being slightly drawn into that opening) a further length of flue-pipe should be added to that already fixed, and a false register fitted, if necessary.

(5) Ball fuel should be packed lightly and in such a manner as to keep it as far as possible away from contact with the flames, and so as to enable the flames to play through the holes in the fuel rather than against the solid portion of it. Whenever possible, oblong fuel with open ends should be placed end-up in the first two rows above the burners, one piece directly above the other, so as to allow free play of the flames through the fuel. The rows above should be laid horizontally so as to catch the heat. Care must be taken to see that no fuel broken small is left in the fire, and also that there is a proper

quantity (not an excess) of fuel to make full use of the heating power of the flames.

(6) The fitter must see that the burners are thoroughly clean and free from roughness in the casting; that the injector is fitted and adjusted truly so that all the gas flows directly into the burner and that none escapes on either side of the air chamber; that the injector is thoroughly clean; that the flames in the burners are equal; that a proper mixture of air and gas takes place; and that the fire burns silently. If the mixture be not correct, the injector should be very slightly opened or closed, or, in the case of fires fitted with an air or gas regulator, such regulator should be adjusted so as to give the proper flame. A very slight adjustment of the injector makes a considerable difference in the mixture. In opening out an injector, each hole should be very slightly broached out by means of a special broach; the plan of considerably broaching out only one or two of several holes must not be adopted. The injector must be changed if a good result cannot otherwise be obtained.

(7) Care must be taken to see that the stove is set firmly in its place and is on the level, and that no rubbish is left in the grate behind. Consumers should be politely cautioned against throwing matches, cigarette ends, &c., into the fire.

(8) The fitter should see that the stove is large enough to heat the room, and, if it is not, report the fact, so that the Inspector may take the matter up with the consumer.

(9) The top of the stove should be examined carefully to see that the radiating chamber is sound and that no fumes can escape therefrom; the stove being exchanged if defective.

(10) Care should be taken to see that the supply of gas is sufficient. If the supply is inadequate, it is necessary first to make sure that there is no dirt or stoppage in the cock. If everything is found in order, and the deficient supply is found to be due to too small a supply-pipe, the circumstances must be reported and the Inspector's instructions awaited.

(11) The plugs of cocks should not be allowed to grind on the hearth or floor board.

(12) In fixing a governor it is necessary to see: That the barrel and fittings are thoroughly free from dirt, filings, &c.; that the gas-way of the cock is free from grease, sand, or other obstruction; that no dirt has gone into the governor, and that it is properly in action; and that the governor is fixed between the cock and the fire, with the inlet side to supply.

The governors sent out for each fire are adjusted to give the proper quantity of gas required for the efficient working of that fire. If, however, at any time, the governor is found to give too much gas, the small iron screw at the side should be slightly screwed in, and the reverse if there is not sufficient gas on the outlet while plenty on the inlet of the governor. The supply should not be increased, however, unless it be found to be insufficient after the fire has been alight some little time.

If a governor should at any time require cleaning, this can be done (without disconnecting the governor) by unscrewing the plate on the top, and taking out the valve by means of a piece of rolled paper inserted in the tube to lift it out. The cylinder and centre hole in which the valve works should then be wiped with clean rag on a piece of wire of suitable size. The tube and outer edge of the valve should then be wiped and replaced in the cylinder and the plate screwed on; a little firm grease being used on the screw—so rendering it easier to unscrew again when necessary. The whole operation should not take more than five minutes.

(13) Woodwork in the vicinity of a stove must always be carefully protected, by sheet iron or asbestos, from any risk of scorching or being fired.

(14) The proper way to light the stove should be explained to the consumer and to his servants; the stove being shown both lighted-back and lighted properly.

Gas-Fires in Grates.—Rules Nos. 5, 6, 8, 10, 11, 12, and 14 are to be observed.

(15) Where a gas-fire is about to be fixed in a grate, the consumer should be advised to have the chimney swept before the work is commenced, to avoid trouble arising out of soot afterwards falling on the asbestos.

(16) In cases where there appears to be an excessive draught up the chimney, a false register should be fitted, with an aperture cut therein fully sufficient to allow the products of combustion to escape up the chimney. The partial closing of the existing register, wedged up to keep it partially open, should not be relied upon.

(17) In case of a down-draught, the consumer should be advised to fix a cowl on the chimney, and the fixing of the fire should not be proceeded with until the Inspector has been informed of the fact and has received the consumer's instructions.

(18) The fire-brick or fire-clay in the grate should be properly set and well forward. The latter is most essential in order that the heat may be deflected into the room instead of wasted up the chimney.

Condensing and Syphon Stoves.—Rules Nos. 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14 are to be observed.

(19) Fitters must see that the condensing tubes are clear, and that the flames do not come outside the stove, as this causes an offensive smell, and has often been a source of trouble.

(20) The joints of tubes must be examined where they are fitted into the frame of the stove, to make sure that there is no escape of fumes through leaky joints.

Cooking-Stoves.—(21) Fitters must see that all utensils usually supplied with the stove have been delivered and are in proper condition.

(22) All burners, injectors, air-chambers, deflectors, and oven ventilators should be examined carefully and adjusted where necessary.

(23) Fitters should ease or grind-in any taps that require attention, and see that none of the taps are too loose. This point must receive careful attention.

(24) Care must be taken not to fix the stove in a draughty place, either by a back door or between a door and window, or where there is a strong ground draught. If this cannot be avoided, it is advisable to fix an L-shaped piece of sheet iron under the base-stone on the side affected by the draught, to act as a wind-guard; but the foreman should be specially consulted in all such cases. A strong current of air blowing through a stove not only prevents the oven getting hot, but meat, cakes, pastry, &c., are spoiled in the cooking, and take twice as long to bake as they would with proper heat.

(25) A draughty scullery is not at all the best place for a gas-cooker, and consumers should always be advised to have cookers fixed in their kitchens; and then, for preference, not in any recess, where they cannot be easily got at, but in a convenient spot (by the side of the kitchener if possible), with a good light overhead. A gas-stove fixed in the kitchen is always kept in much better order, and better cared for, than one relegated to the scullery.

(26) Cooking-stoves do their work better without a flue-pipe. If the gas is turned half-way off during cooking, there is no occasion for a flue; and the Company's lecturer (Miss Edden) never advocates its use or has one put to her own stove. If a flue be used, it must not be carried into the open air.

(27) Fitters must explain the use of the different parts of the cooker to the consumer or the servants, if requested to do so; and always point out to the consumer that the Company are prepared to send, if desired, an expert lady demonstrator to give full instructions in the use of gas for cooking—carefully noting and reporting any request for the demonstrator to be sent.

LII.—*Leaving Premises—Clearing up and Leaving as Found.*

No workman should leave a consumer's premises unobserved; but, after clearing up and leaving as found, should take care to announce that he has finished for the day, or completed the work, as the case may be.

Upon leaving premises after the completion of a job, it is desirable politely to draw the attention of the consumer, whenever possible, to the work executed (together with improvements made, if any) for the purpose of obtaining an expression of satisfaction, which should be recorded in the pocket work-book at the time.

LIII.—*Avoiding Waste of Time and Material.*

Care must always be taken not only to avoid waste of time and material in the carrying out of any job, but also to see that any materials (however small in quantity) left over on its completion are duly returned to stores. The Company's annual expenditure on wages and materials is very heavy; and if every man would always do his utmost to avoid and prevent waste of time and material, the saving to the Company would be considerable—and, as every sensible man is aware, the cheaper the Company can work, the cheaper they can sell gas; the lower the price of gas, the more gas is sold; and the more gas there is sold, the more labour is required for its manufacture and distribution.

LIV.—*Subways.*

[This rule contains regulations relating to work in London subways, and would not be of general interest.]

LV.—*New Unvalved Services—Avoiding Work with Live Gas.*

In the case of new unvalved services being laid to warehouses, factories, hotels, or other large buildings, where the Company have undertaken the work of extending the service to the meter position, arrangements are made for a fitter to attend at the same time as the service-layers, to carry out the inside work (including the fixing of the main-cock) before gas is put into the service. Notice is given by the Mains Department of the day and time the service will be laid; and care must be taken to see that the fitter is in attendance in good time, so as not to delay the service-layers. The fitter must in all cases test his work after the service has been charged.

LVI.—*Connections to Existing Carcase Pipes.*

No existing, but temporarily disused, carcase pipes in any premises may be connected to the Company's service and left charged with gas until those pipes have been put under a gauge test with 6-inch pressure, and have been passed by the foreman as sound.

MANTLE MAINTENANCE.

Note.—The following Rules apply specially to maintenance fitters, who must, however, note carefully all the preceding rules, as many of those rules apply to them as well as those which follow.

LVII.—*Uniform.*

Upon entering the Company's service, each maintenance fitter is provided with a uniform cap, and at a later period with a complete uniform, consisting of tunic, vest, pair of trousers and overcoat; and the Company hold him responsible for the safe custody of each of the above. The uniform must be produced complete at any time when called for, and must be returned to the Company whenever the fitter leaves the service.

LVIII.—*Box and Tools.*

Each fitter is supplied with a maintenance box containing sundry tools and materials; and he is held personally responsible for the safe custody of these, and required to pay for the replacement of any article missing at any time an examination is made. The box and contents must in every case be left with the storekeeper each night.

LIX.—*Stock.*

Each fitter will be held responsible for all goods issued to him daily, and should any be missing at any time, he will be liable to pay for the replacement of same, or to dismissal if he cannot give a reasonable explanation of the shortage.

LX.—*Loops, Ash, and Boxes to be returned to Stores.*

The fitters are required to collect and bring in to the stores the asbestos loops of all mantles replaced, together with the ash of the old mantles, and to bring back all the empty cardboard mantle-boxes.

LXI.—*Pocket Book.*

A pocket book is supplied to each fitter, in which he is to make all notes necessary during his work, including any request of consumers or their servants, and to report the same in writing immediately on his return to the office, in the book kept for that purpose.

LXII.—*Orders from Consumers.*

An order book is issued to every fitter, and he must respectfully ask the consumer to sign an order for anything required outside the usual maintenance work, unless the maintenance card contains instructions

to supply free of charge. If his order book is lost at any time, the fitter is liable to be suspended from duty until the same is found.

LXIII.—*Fitters not to accept Payment or do Work on their own Account.*

Any fitter accepting payment from any consumer for any goods or for any work done, or undertaking maintenance work on his own account, will render himself liable to prosecution as well as dismissal.

LXIV.—*Usage of Mantles.*

The usage of mantles must be kept as low as possible, compatible with the maintenance of efficient lighting. All causes of heavy usage must be promptly reported.

LXV.—*Daily Report Sheets.*

The time of arrival at consumer's premises, and of leaving, and all material used on each job, must be correctly entered on the report sheet, on the completion of the job.

LXVI.—*Correct Particulars on Card.*

Fitters must see that the name, address, and all particulars on the inspection card are correct, and report any alteration required on return to the office. On no account may the fitter alter the card.

LXVII.—*Contract.*

On being given contracts to verify, the fitter must carefully count the burners, and ascertain that the number and type agree with the particulars shown on the contract, and that the contract covers all the incandescent burners on the premises. On no account must he make any alteration, but must report any discrepancies at the office.

LXVIII.—*Escapes.*

Escapes must be reported immediately on return to the office. Fitters must, if possible, temporarily secure the same with white lead while on the premises. If the escape is serious, the fitter must at once telephone or telegraph to the office, giving all particulars.

LXIX.—*Complaints of Bad Supply of Gas.*

Complaints of bad supply must be carefully noted and be reported on return to the office; but the fitter must first be careful to make quite sure that the complaint is not due to defective or dirty burners.

LXX.—*Fixing Globes.*

Fitters must use special care, in fixing globes of lamps or of inverted burners, to see that they are left secure, but not screwed up too tightly. Sufficient room must always be left for expansion by heat—say, about $\frac{1}{16}$ of an inch at least.

LXXI.—*Breaking of Globes.*

Any globe broken by a fitter during his day's work must be noted in his pocket book and replaced the same evening. In all cases where a globe is found cracked, the fitter must draw the consumer's attention to the fact, and ask for an order to replace, before attempting to touch same—unless he has instructions on the card to replace free.

LXXII.—*Use of Trestles, &c.*

On no account must trestles or steps be left unprotected in the public footway. A fitter using them should ask one of the consumer's employees to keep watch, should he have cause to leave them.

LXXIII.—*Bonus.*

Fitters are paid a quarterly bonus of 4d. for every burner maintained on the average per day by the fitter in excess of an average of 150 burners per day, provided the work is carefully and properly carried out, and that the attendance and general conduct of the fitter is in every way sa isfactory.

Unaccounted-for Gas and Consumers' Meters.

Sir,—Mr. Norton Humphrys, by his communication which appears in your issue of the 9th inst., considers that a large portion of unaccounted-for gas is attributable to consumers' meters, owing to insufficient importance being attached to the test for soundness apart from slow registration; and he offers several suggestions for consideration, with a view to the amendment of the law. I believe many of your readers will agree with me that insurmountable difficulties would be met in attempting to put into practice the proposals stated, while no suggestion is made of the more important matter of varying speeds and pressures that is raised by the communication.

To take first the illustration of the ten-light meter. This can, as Mr. Humphrys states, be tested for soundness while passing 3 cubic feet per hour, but may also be tested while passing only $\frac{1}{2}$ cubic foot per hour. Seeing that the object of such tests is to determine if small amounts are recorded, the $\frac{1}{2}$ cubic foot test is the better procedure; and a more stringent test for unregistered gas, in practice, could not well be imagined.

The striking out of the percentage error slow allowed in favour of the buyer, would appear somewhat supported by official certification; but when dry meters do not pass unregistered gas at the valves, or their measuring chambers are not defective, the tendency is that they become faster after a time in use, until either the valves or the chambers are defective. The turn of the scale would, up to this stage, have a strong tendency in favour of the seller. The certificates referred to are evidently for meters beyond this stage; and if so, they could not well be taken as representing the state of the meters when approved and stamped as legal measures.

The Act is considered to provide against the stamping of meters that are capable (by any means prevented in good meters) of registering in error beyond certain limits. There are good meters that will register correctly under varying speeds and pressures; and, obviously, it is necessary to make certain other tests that are not actually prescribed, in order to ensure that only such meters are stamped.

My object in making the foregoing statements is to give what I consider the more practical side of an important question. In my opinion, were periodical testing established by law, the Act would, of necessity, be more generally adopted, and every facility for the testing of meters officially would be thereby provided, and defects such as those Mr. Humphrys sets forth would be prevented. The methods of other tests if actually prescribed, would make more clear the importance of section 12 of the Sales of Gas Act. This, of course, may not cover all that is desired; but it would meet the difficulties raised.

Nottingham, July 18, 1907. F. Coe.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, July 18.

(*Before Mr. Justice* Bray.)

Attorney-General v. Felixstowe Gas Company—Question as to Liability for Stamp Duty.

This was an information which came before the Court in the form of a special case raising the question whether the defendant Company were liable to pay an *ad valorem* stamp duty, amounting to £118 15s., with interest, on their Act of 1904, on the ground that it vested the property of the former limited Company in the new Company "by way of sale," and so came within the provision of the Finance Act, 1895.

The Solicitor-General and Mr. Finlay appeared for the Crown; Mr. Cripps, K.C., and Mr. Spence represented the respondents.

Mr. Cripps said he should admit at once that there was no question of figures, if there was here a conveyance by way of sale; but his contention was that there was no sale. In order that there should be a sale, there must be two parties, the vendor and the purchaser; and in most of the cases which had arisen, this had been the real question at issue—whether there were two contracting parties. Here it was impossible that this could be the case, because the old Company was dissolved at the same moment that the new one came into existence by virtue of the Act of Parliament; so that they were never in existence at the same time, and could not therefore contract with each other. Counsel went through various cases in which it had been held that the stamp duty was payable, and pointed out how, in his view, the present case differed from them.

The Solicitor-General having addressed a very short argument to the Court,

Justice Bray, in giving judgment, said the question turned on a few words in section 12 of the Finance Act, to the effect that, after the passing of the Act, if by virtue of any Act any property is invested in any person by way of sale, the duty was payable. He had to consider, therefore, whether it was satisfactorily shown here that by this Act of Parliament property was vested by way of sale in any person. It was quite clear that the two persons were different—the two Companies were different entities, the limited Company and the new statutory Company. It all came back to the question: Was the property vested in the new Company by way of sale? What was necessary for a sale? No doubt, without the help of an Act of Parliament, it was necessary that there should be two parties, a consideration, a consensus, and a transfer. The difficulty suggested here was that no two parties ever existed at the same moment, and, further, that there was no concensus, because, inasmuch as the two parties never existed at the same moment, there could be no consensus, which meant a meeting and agreement of the minds of the two persons together. He thought, however, that the concensus might be inferred from the Act of Parliament. It might be an artificial consensus, not a real one; and the two parties might not be alive at the same moment. But if one could see from the Act of Parliament that it was all based on a real consensus between the new Company and the old one, in his opinion the Act might create that which the two persons together could not do. And in this case he thought the Act did create a consensus between the two parties. Equally it might be said that a transfer meant a transfer from one existing person to another; and that these two persons never existed together at the same time. But he thought the Act might supply this deficiency, and might say this was to be treated as if it were a transfer from the one Company to the other. This view was supported by Lord Esher's judgment in *Great Western Railway Company v. Commissioners of Inland Revenue* (L.R. 1894, 1 Q.B.), where he appeared to think that the words "by way of sale" were satisfied if the transfer of property was for consideration, as if it were a contract for purchase and sale. It seemed to him (his Lordship) that it was not necessary in terms that there should be two parties existing at the same time and actually agreeing. In his opinion, therefore, this property was vested, by way of sale, in the new Company; and consequently the duty was payable.

Judgment was therefore given for the amount claimed, with interest and costs.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Monday, July 15.

(*Before Mr. Justice* Swinfen Eady.)

Edge and Others v. Metropolitan Water Board.

This was an action brought by the freeholders of certain houses in Crescent Grove, Clapham, to obtain a declaration that the defendant Board are liable, under an agreement entered into by their predecessors, the Southwark and Vauxhall Water Company, to supply houses on the Crescent Grove Estate with water at the yearly rent of 34s. per house, and are not entitled to enforce any higher charges.

Mr. Eve, K.C., and Mr. Kenneth Wood appeared for the plaintiffs; Mr. Danckwerts, K.C., and Mr. Harold Burrows represented the Water Board.

Mr. Eve said the first plaintiff, Mr. Edge, was the owner in fee of four houses on what was known as the Crescent Grove Estate; the plaintiff Clark was the owner of another house; and the plaintiff Alfred Clarkson was also the owner of a house, though it stood in the name of his wife, and he and Mr. Edge had been appointed Trustees of the original agreement. The Crescent Estate was conveyed in 1824 to Francis Child, and by the year 1830 some 39 houses were erected upon

it, when he began to dispose of them. Mr. Samuel P. Child, through whom Mr. Edge claimed, became the owner of one of these houses. The original Southwark Water Company was incorporated in 1834, and on Sept. 25, 1841, the Company entered into the agreement on which the action was founded. In 1845, the Act was passed under which the Vauxhall Company was merged in the Southwark Company; and one of the defences appeared to be that at this time the Southwark Company ceased to exist, and the agreement, if made, came to an end. Various other Acts were obtained from time to time; but the agreement was continuously acted upon down to 1902, when the Act was passed incorporating the defendant Board. This provided that on the appointed day, which was June 24, 1904, the undertakings of the various Metropolitan Water Companies should vest in the Board; and all their rights and obligations were transferred to that body. For two years the defendants continued to supply water on the old terms; but last September they gave notice that they would not do so any longer, and those who were interested in the estate had to look carefully into the matter. After an industrious search, the agreement was discovered in the possession of some solicitors who had represented the owners of one of the houses; and it was now produced. By an indenture dated March 19 last, made between some of the freeholders and Mr. Edge and Mr. Clarkson, the last two gentlemen were appointed Trustees of the original agreement, with the right to sue on the covenants therein contained. The learned Counsel read the agreement, which was made between the Southwark Water Company of the one part and Samuel P. Child and George Child, on behalf of themselves as freeholders, and as Trustees for and on behalf of the other freeholders of the several houses mentioned, and provided that the Company should, at their own expense, lay mains and pipes so that pure filtered water should be used by all the occupiers, receiving a payment of £30 for the first year, and from and after December, 1842, would supply the houses specified, and as many others as should be built on the estate, at the rate of 34s. per annum, to be paid by the occupier for the time being. A provision was inserted that the charge should not be payable if and when any of the houses were unoccupied. In the event of the Company not performing the agreement, becoming dissolved, or ceasing to exist, the mains, pipes, &c., should become the property of the Trustees for the benefit of themselves and the other freeholders. The Trustees also covenanted that the Southwark Company alone should be permitted to supply the houses on the estate with water. At this date, the Act of 1834 was in force; and one of the defences raised was that the agreement was altogether *ultra vires*. He, however, did not see how this could be sustained. Having briefly referred to the other Acts, the learned Counsel read section 45 of the Act of 1902, which stated that all contracts, agreements, &c., subsisting immediately before the appointed day, and affecting any Metropolitan Water Company, should have as full force and effect against, or in favour of, the Metropolitan Water Board as if, instead of the Water Company, the Water Board had been a party thereto. Having referred to the various defences raised, he said the whole question was whether the dissolution of the Southwark and Vauxhall Water Company had in fact put an end to the agreement; and he submitted that it had not.

Mr. DANCKWERTS addressed a long argument to the Court on behalf of the defendants. He submitted, in the first place, that the agreement was entirely *ultra vires;* that even if the Company had power to enter into it it was invalid in itself on various grounds, and that the present plaintiffs had no authority to sue upon it. If the construction put upon it by the plaintiffs were correct, he submitted that it would offend the rule against perpetuities. But the obvious intention was that the agreement should come to an end if the Company was dissolved; and as this had taken place, the agreement was no longer in existence. On the whole, he submitted that the contract was not one which could be enforced.

Mr. BURROWS followed with an argument on the point as to whether the plaintiffs were entitled to sue.

Tuesday, July 16.

Mr. BURROWS continued his argument this morning, and submitted that, assuming the plaintiffs were freeholders, they must show that the benefit of the covenants in question ran with the land; and this could not be the case, as there was no privity of estate between the covenantor and covenantee, which, in his view, was essential. He developed this abstruse legal argument at some length, and cited several authorities in support of it.

Mr. EVE having replied,

Mr. Justice SWINFEN EADY gave judgment. After reciting the agreement and the relevant sections of the Act of 1902, his Lordship said the first question that arose depended on the true construction of section 45 of the Act. Was it to put the Water Board into the position for all purposes of the Water Company, and was it to be read as if it contained the words: "The Water Board shall, as from a certain date in the past, and thenceforth during the continuance and existence of the Board, supply water" at the fixed rate? Sub-section (*b*) set forth: "All contracts and agreements subsisting immediately before the appointed day, and affecting any Metropolitan Water Company, shall be of as full force and effect against or in favour of the Water Board, and may be enforced as fully and effectually as if, instead of the Company, the Water Board had been a party thereto." The first step was to see what was the position immediately after the appointed day—June 24, 1904. Assuming the agreement of 1841 had been valid and enforceable in every respect, then, until the Southwark and Vauxhall Water Company was dissolved, the provisions of the agreement were to have full force and effect against the Water Board; so that from June 24, 1904, until June 5, 1906 (when the Company was dissolved by publication in the "London Gazette" of the Board of Trade certificate to this effect), if there were no other objection to the agreement, it could have been enforced against the Water Board as fully and effectively as it could against the old Southwark Company. But, in his opinion, this section dealt with enforcing contracts against the Board, and did not alter the substantive rights of the parties. The agreement was only to continue, according to its tenor, during the continuance of the Company; and in the provision for enforcing contracts against the Board, he was unable to find any words which justified him in altering the substantive contract, and saying that it was to be read as if it were to continue during the existence of the Board. At the date of the agreement, it perhaps might have been contemplated that the undertaking of the Southwark Company might have been sold or transferred to some other company, in the same way as the Vauxhall Company was transferred to the Southwark Company; and probably the latter Company did not intend to fetter themselves by any contract enduring longer than, according to the tenour of the instrument, this was to endure. In his opinion, the effect of the section, while it enabled the contract to be enforced against the Board, only enabled it to be enforced according to the tenor of the contract itself; and so soon as the Southwark and Vauxhall Company were dissolved, the agreement came to an end. Under these circumstances, he thought the action failed, so far as it claimed to enforce the right to have water at a specified charge. Assuming every other point in the plaintiffs' favour, this point was fatal to the success of the action, which must be dismissed, with costs.

GREENWICH POLICE COURT.—Thursday, July 18.

(*Before Mr.* CECIL CHAPMAN.)

Lewisham Borough Council v. South Suburban Gas Company.

Alleged Nuisance—The Disposal of a Gasholder's Tank Water.

This was a summons issued, on the application of the Lewisham Borough Council (who were moved to take action by certain inhabitants in the district), against the South Suburban Gas Company for causing effluvia in the manufacture of gas.

Mr. A. S. POYSER appeared for the Council; Sir CHARLES MATTHEWS, K.C., for the Company.

Mr. POYSER, in opening the case, said the information alleged that the Company, in the manufacture of gas at Lower Sydenham, caused effluvia; and this was certified to the Sanitary Authority by ten inhabitants of the district as being a nuisance. What he said was that the Company unlawfully carried on their business so as to cause a nuisance. The date more particularly charged was April 11, when the inhabitants suffered especially from the nuisance. This was the only date charged. No doubt the effluvia had been there some days before; but on April 11 it was worse than on any other day, and that was the day particularly for which they claimed a fine in regard to the nuisance. The information was laid under the Public Health Act, 1891, section 21:

> Where any manufactory, building, or premises used for any trade, business, process, or manufacture, causing effluvia, is certified to the Sanitary Authority . . . by any ten inhabitants of the district of such authority to be a nuisance or injurious or dangerous to the health of any of the inhabitants of the district, such Authority shall make a complaint; and if it appears to the Petty Sessional Court hearing the complaint that the trade, business, process, or manufacture carried on by the person complained of is a nuisance, or causes any effluvia which is a nuisance, . . . then unless it is shown that such person has used the best practicable means for abating the nuisance, or preventing or counteracting the effluvia, the person so offending . . . shall be liable to a fine not exceeding £50.

The Gas Company were within the section as the person liable for what took place in the manufacture of gas. The Company's works were situated at Lower Sydenham; and the district was hilly, with a gradual rise from the works up to a very important residential area. The inhabitants of this area had suffered at the hands of the Company very considerably, through the smells they made. It was not the ordinary smell of the gas-works; but something far beyond the ordinary. All the signatories to the certificate were well-known gentlemen in the locality; and they occupied houses of considerable value at a short distance from the gas-works on the rise towards Sydenham. Most of them were situated in the Dacres Road, which was a purely residential road. The gentlemen who inhabited these houses would all come and tell his Worship that the smell had been practically unendurable—especially so on the 11th of April, when the stench was such as to make living a positive burden. The Medical Officer of Health and the Gas Company were spoken to on the matter; and the latter suggested that the smell was owing to the sewers. This was a gas smell and not a sewer-gas smell at all. The Medical Officer of Health, in consequence of the complaints, went to the gas works, and saw Mr. Shoubridge, the Company's Engineer, who pointed out to the Medical Officer certain work they were doing on the premises, which certainly conduced to a very obnoxious smell. That alone would be a sufficient corroboration of the witnesses' declaration that the smell did come from the gas-works. The suggestion made at the gas-works was that it was due to a temporary operation there. But it was an operation that might recur; and so there was no option but for the Sanitary Authority to take action.

Mr *J. R. Furneaux*, of Boxgrove House, Mayow Road, Forest Hill, stated that he had lived there for some 37 years. His house was rated at £175. The district was a residential one, with good houses all round. He was a Past-Master of the Leathersellers' Company; and they owned large estates in the neighbourhood. He himself owned several houses there. With regard to the smells, they were particularly strong about the beginning of April; and on the 11th of that month, he noticed it more than usual. The nuisance had been in existence, and growing in intensity, for some period about that time.

His WORSHIP: Do you mean that the nuisance lasted all day, or was it at a particular period of the day?

Witness replied that he had noticed it more particularly at night. Returning home one night by a train arriving at Lower Sydenham at 12 minutes to 10, the smell was "most atrocious;" and as he got farther from the works, the smell became less. It was so "atrocious" about this period that it was enough to take one's appetite away.

Examination continued: Although the smell lessened as he got nearer his residence, it was most offensive there. His house was about ten minutes' walk from the station. Since the notices had been out for this matter, the smell had subsided. He had gone out purposely of an evening by the gas-works, and he had found the smell had subsided.

His WORSHIP: You do not mean subsided, but disappeared.

Witness: Yes.

In cross-examination by Sir CHARLES MATTHEWS, witness was asked at what date he fixed the "notices having been out for this matter." His reply was when the first subpœna was issued—about July 3. Before then, the smell had been growing gradually more and more. He believed it had been in existence a year or two; but it had been growing more and more until it became nauseous in the extreme. The question was put as to when he last noticed the smell; and he replied about a month after April 11 and 12—say, about the middle or the end of May. His house was about 733 yards from the works; and there were residences much nearer the works than his. So far as his knowledge went, there had been no complaints regarding the sewers in recent years; and the sanitary arrangements of the district he believed to be good now. He was about the neighbourhood in all directions, but he did not know a large sewer was being laid in this immediate vicinity.

Re-examined: The houses between the gas-works and his house were at a lower level. The smell that he had noticed near the gas-works was the smell which extended to his house, only it was modified the further he got from the works.

His WORSHIP: You say the smell was particularly offensive. The ordinary smell of a gas-works is not offensive; it is disagreeable. You do not mean this was an ordinary gas smell.

Witness: It is the smell that I have noticed on passing the gas-works.

Mr. *Walter Mason*, of Woodfield, Dacres Road, Forest Hill, deposed that he had resided in his house for fourteen or fifteen years. Whenever this year the wind had been in the east, they had been virtually "stunk out." He noticed the smell particularly on April 11, about a quarter past eight in the evening. He had observed it as far off as Forest Hill Station that evening. Going later down the hill in a line with the gas-works to a friend's house in the Mayow Road, the stench was simply abominable. The smell was still "on" when he left his friend's house; and even next morning they could smell it. The smell generally happened in the evening, and sometimes in the middle of the night. It not only interfered with the comfort of living, but interfered with the growth of plants. It produced an oily film on the leaves, which looked almost like blight. They had had the smell worse this last March and April, whenever there was an east wind.

Cross-examined: His house was about 700 yards away from the gas-works. The smell had not ceased. They had it only the previous Sunday evening, and again on Monday morning. He had never heard of any complaints against the sewers in his neighbourhood. He had some knowledge that a hole had been dug in Lower Sydenham; but he could not say whether this was due to alterations in the sewerage system. However, that would not be in such a direct line with his house as the gas-works. He did not know the number of sewer ventilators in the road near his dwelling; but there was an ordinary grating in the middle of the road, which he supposed was connected with the sewers. They had the smell whenever there was an east wind; but he did not know the direction of the wind on April 11. They had the same smell very badly in 1904; and it ceased more or less for two years. Now it had come on again strongly. He could not say that the smell in 1904 was due to lime purification; and he did not know that the process had been abandoned at the works.

Mr. *Gilbert R. Redgrave*, of "Thriffwood," Silverdale, Sydenham, Assoc.Inst.C.E., and Assistant-Editor of the Engineering Supplement of "The Times," also stated that, whenever the wind was in the east, or varying a little round that quarter, they had at his house the intolerable smell of sulphuretted hydrogen. He had a great knowledge of the effects of this gas. Many years ago, working as an engineer, he happened to be accidentally poisoned by it, and ever since then he had been specially subject to poisoning by sulphuretted hydrogen. He had several times of late been awakened in the night by sulphuretted hydrogen, borne by the east wind. His house was some 3350 feet west of the gas-works. The smell was particularly strong on April 11, and on previous and subsequent days. He was astonished that the smell should be so concentrated at such a distance from the works.

In cross-examination, witness was asked whether he would not expect, having regard to the pungency of the smell, that it would arise from some source nearer to his house. His answer was that he should not; and that he believed it to be solely produced by the process used for enriching the gas.

His WORSHIP: Enrichment by what?

Witness: Carburetted hydrogen.

Cross-examination continued: He had only lived in his present house three or four years, and had noticed the smell on and off ever since—at any rate, very badly for the past twelve months, and almost up to the present date. He had never heard of any complaints regarding the sewers in the district; and he had never noticed any smell from sewer ventilators in the neighbourhood of his house. The smell was entirely different from sewer gas.

Mr. *G. J. Freund*, Lancaster House, Dacres Road, said he had no doubt about the smell coming from the gas-works. It was so bad that they had to close their windows at night; and both his wife and maids had complained. As to the suggestion of sewer gas, it was nothing of the kind.

Cross-examined: Regarding the controversy in 1904, he could not say whether or not lime purification had been discontinued at the gas-works, nor could he say that he had noticed any difference between 1905 and now. His house stood in a line with the gas-works—about 600 yards away. The smell was noticeable at intervals from January to March this year, culminating about the middle of April. Since then the inconvenience had diminished; but it certainly had not ceased. The week in April was unquestionably the worst. He had never been under the impression that the smell came from the sewer ventilators.

Mr. *T. Fletcher Adams* was then called, but

His WORSHIP intervened with the remark that he did not think it necessary to waste the time of these gentlemen further. He thought he could assume that they, being signatories to the complaint, were in agreement.

Sir CHARLES MATTHEWS said he did not want to see more of them; he assumed they would give the same evidence.

Mr. *J. H. J. Selje*, of "Ightham," Mayow Road, asked to be allowed to give evidence. He corroborated the testimony of previous witnesses, and added that the processes the Company had in use for some four years were very objectionable; but since the adoption of their new processes, the smells had been remedied, though not cured. They still continued, but had certainly diminished. The smell, however, increased in intensity on and about April 11.

Dr. *Arthur Wellesley Harris*, Medical Officer of Health for Lewisham, said that on April 18 he personally noticed a nuisance existing in his district, apart from the complaints he had received. It was late in the evening; and the odour was perfectly characteristic of gas-works. There could be no doubt that the odour arose from the waste material of the gas-works, or from the contents of a gasholder tank. On April 19 he paid a visit to the gas-works, and saw Mr. Shoubridge. In consequence of the observations he (witness) made on the 18th, he asked Mr. Shoubridge whether they were discharging refuse matter into the sewers. His reply was that he had no other place to put it. The material was highly gaseous in its composition; and being put into the sewers, and the sewers being warmer than the refuse, would lead to evaporation of the gaseous constituents very quickly, and on a still night would fill the whole of the district through which the sewers passed. If the wind was blowing, it would, of course, diffuse quickly. Where he lived, he noticed it more particularly when south winds were blowing. The odorous material came from the gasholder tank; and it was in carrying out work on the gasholders that they had to get rid of this material. The emanations from the sewer-openings were caused by the material the Gas Company were putting into the sewers.

Sir CHARLES MATTHEWS: You see we were not far wrong.

Examination continued: The top being partially off the holder at the works, the gaseous constituents would evaporate in large bodies. It would depend greatly on the direction of the wind as to the residences this would affect. He could quite understand that if this oily material was carried in a fine state of division, it would settle. The nuisance had diminished considerably. Some, however, still existed. He noticed it between 8 and 9 o'clock the previous Sunday night; but it was nothing like so pungent as on April 18.

Cross-examined: According to his observations on April 18, the smell did come from the sewers—from outside the works, and from the districts below through which the sewers passed after leaving the works. The sewers on which he made his observations were a considerable distance from the residences of the complainers. The gas would, of course, pass up side sewers. On April 19, Mr. Shoubridge was good enough to show him the condition of the contents of the gasholder tank; and he explained to him what was being done in the enlargement of the holder, and also that it was necessary to pump the water away. It was obvious that it was impossible, having regard to the length of time the water had stood there, to avoid some smell.

Sir CHARLES MATTHEWS: Did he ask you whether the best means were not being used, having regard to the necessary alteration of the gasholder, to avoid the smell.

Witness: I do not think he would ask me a question on that point. I think he said: "What else would you do?"

Did you agree that he could not do anything else?—No; certainly not.

I put it to you, Dr. Harris, that you did?—I must leave that with my denial.

You agree that the Company to carry on their business must from time to time make alterations in their plant?—Absolutely.

Did he tell you how long the water had been in the tank?—May take it you mean the sediment or the water?

The water?—No.

Did he give you about seventeen years as being about the time?—That was the time for the sediment.

And did you say that what must be done must be with as little smell as possible, and that he was to get the water out as quickly as he could?—I agreed they must dispose of the water.

Did you suggest how it was to be done?—No. Mr. Shoubridge said he had taken the best means.

Did you say to him: "Don't put the water into the river?"—No.

Put it into the sewers?—No, absolutely.

You are quite sure about that?—Absolutely sure.

While you were at the works, did you see them turning water into the sewer?—I did not. There was no action going on at the time.

Did you see a pipe there?—Yes, in the bottom of the tank.

By means of which the water was being carried to the sewer?—I presumed it was. They admitted that they were putting it into the sewer, because Mr. Shoubridge told me in the presence of those who were with me they had been doing so.

Did you raise any objection to that?—I said it was a serious thing putting it into the sewer. That was what made Mr. Shoubridge say "What else would you do?" To that I made no answer.

I suggest that you said he was not to put it into the river, and that he was to put it into the sewer?—I am absolutely confident I did not.

In further cross-examination, witness said that wherever there were sewers, they had complaints; but the smell was a totally distinct one. He knew that the cleansing of the sewers went on at night time; but he was not aware of complaints as to the sewers being too small. There was a large sewer now being constructed in the immediate neighbourhood of the gas-works in Sydenham Road. He believed this was to provide additional drainage facilities for the neighbourhood.

Re-examined: He did not direct that the water should be pumped into the sewers. That he knew was an offence.

Mr. POYSER: For which the Company are not being prosecuted. I hope they do not complain of that.

His WORSHIP: Can you speak as to whether this nuisance could be traced to temporary works—enlarging holders and things of that kind—which might cause temporary inconvenience, but yet be unavoidable?

Witness: It has to occur from time to time. This nuisance, however, has been going on for some considerable period; and it has been aggravated.

His WORSHIP: The suggested defence is that this is an unavoidable trouble.

Mr. POYSER: I gather from my friend's cross-examination of witnesses that he is going to set up the defence that the Company have taken all

precautions. Now till we know what they have done, and what they allege to have done, it is impossible for us to meet that case. Therefore it will be necessary to ask for an adjournment.

Mr. *B. Nappett*, one of the Sanitary Inspectors, also gave evidence.

Sir CHARLES MATTHEWS, in addressing his Worship, said he hoped he would dismiss altogether from his mind anything which had relation to 1904; and for this reason, that from that time there had been in use a different system of purification, and there had been complete freedom from all possible offence as from the gas-works. Coming to April of this year, it was necessary to enlarge a pair of gasholders—to add additional lifts; and for that purpose, and to sink new rest-stones, the holder tank water had to be pumped out. The work which was said to be the cause of offence was finished on the 24th of May; and if he could prove, as he believed he could prove, that the work was done in the best possible manner, then he should submit that, under the section of the Act, the nuisance was an unavoidable thing, and of short duration. The witnesses had deposed to the same smell in the winter and the summer months; but this could not have arisen from the gas-works, because the cause disappeared on May 24. As between the 11th of April and the 24th of May, there was something; but his evidence would show that the best practicable means were taken in carrying out the work.

After a brief discussion between his Worship and Counsel, it was agreed at this stage to adjourn the proceedings—there being no reasonable prospect of finishing the case at that sitting.

DUBLIN POLICE COURT.—Thursday, July 18.

The Quality of Dublin Gas.

To-day judgment was given on three summonses taken out by the Dublin Corporation against the Alliance and Dublin Consumers' Gas Company, complaining that the Company had failed on three specified nights—viz., the 28th and 29th of January and the 4th of February—to keep the gas up to the specified standard of 16-candle power. The cases occupied a considerable time in hearing; and the proceedings were duly reported in our columns.* The Corporation relied on the evidence of Mr. Thomas J. Cotton, their Official Gas Examiner, who proved that under his tests the gas failed to come up to the specified standard. The defendants impugned Mr. Cotton's method of testing as being defective, and not carried out either in accordance with the terms of an award adopted by both parties in 1889 or with modern practice. They also produced proof that Mr. Cotton's tests were invariably below the results arrived at by the late Professor Tichborne when he was Gas Examiner under the Board of Trade, and also below those of Professor Lewes, who had tested the gas since then. At the close of the hearing on the 1st ult., the Divisional Magistrate (Mr. Swifte, K.C.) who had tried the case reserved judgment, and expressed his intention of visiting the testing-station, and inspecting the instruments used in testing the gas.

Mr. SWIFTE, in the course of a long judgment, announced his intention of dismissing as not proved the two principal charges, and of imposing a penalty of £1 with respect to the third day, when the defendants admitted that, owing to a previous accident at the gas-works and the subsequent leakage in some of the pipes, there was a slight deficiency in the illuminating power of the gas. Having referred to the highly technical character of the case, his Worship said he regretted that the statute did not provide that in such circumstances he should have the assistance of an assessor. The defence practically was based on the unreliableness of Mr. Cotton's testing; and the records of Professor Tichborne's testings were offered in evidence. These showed that for a considerable period anterior to 1905 he and Mr. Cotton continually differed in their results; those of Mr. Cotton being adverse to the defendants, while Professor Tichborne's figures were in their favour. Mr. Cotton also differed from Mr. Brent, who officially tested for the Gas Company, and also from Professor Lewes, the Superintending Gas Examiner to the Corporation of London, who was brought over as an expert witness on behalf of defendants. There must be some explanation of this permanent and substantial difference between Mr. Cotton and Professor Tichborne, extending over a period of years. Both were presumably equally competent and impartial. On this point he was impressed with the emphatic evidence of Professor Lewes as to the necessity of using a cubic foot measure for the purpose of securing that the exact quantity of gas passed through the meter, and also as to the incompleteness of the test if it was not corrected by the readings of the thermometer and barometer for temperature and pressure. Professor Lewes was positive in his opinion that any tests carried out without making these corrections were not worth the paper they were written upon. On the other hand, Mr. Cotton held tenaciously to his own views, and maintained the accuracy of his tests. Professor Tichborne's records had been objected to by complainants as being inadmissable; but, on the whole, he had decided to accept their evidence as affording reasonable presumption with reference to the principal matters in dispute. He wished to speak with great respect of Mr. Cotton as an official of long experience, who did his duty with great conscientiousness. But he seemed to stand too rigidly by opinions which were formed many years ago, and which in some respects had been superseded. Having regard to the evidence placed before him in opposition to Mr. Cotton's direct testimony that the gas was defective, he was obliged to come to the conclusion that the charges as to the 28th of January and the 4th of February had not been proved. As to the 29th of January, it was admitted by the defendants that there was a deficiency owing to an accident three weeks previously. With respect to this date, the statute left him no alternative but to convict; and he would impose a penalty of £1. In conclusion, his Worship said he had carefully considered the question of costs, and would allow the defendants £20 in respect of the two summonses on which there was no conviction. On the other the Corporation would be allowed, in addition to the £1 penalty, a sum of £4; the total of £5 to be set off against the £40.

* See "JOURNAL," Vol. XCVIII., pp. 397, 468, 597, 673.

BREWERY WELL LITIGATION IN EDINBURGH.

A second action has been raised in the Court of Session, Edinburgh, at the instance of Messrs. James Muir and Son, Limited, brewers, of the Calton Hill Brewery, Edinburgh, against the Edinburgh and Leith Gas Commissioners, with reference to the pollution of a well. The former action was disposed of by the Second Division of the Court on May 29, and the summons in the present action was signeted on June 19. In it, the pursuers conclude for £15,000. In their statement, the pursuers say that their business has been in existence for upwards of a hundred years, and it has always enjoyed a high reputation. Within the premises there are two wells, upon which, previous to the pollution complained of, the brewery depended for its supply of water, which is specially suitable for brewing; and the reputation of the pursuers' brewery has been created and preserved by the particular class of beer which this quality of water produces. One of the wells, known as the Stable Well, is on the south side of the North Back of Canongate; while the other, called the Brewery Well, is on the north side of the thoroughfare. The New Street Gas-Works, belonging to defenders, are situated almost immediately to the west of the brewery. The gas-works were dismantled about April, 1904, and since that time the defenders have ceased to manufacture gas therein. In the month of July, 1904, the water in the Stable Well became seriously polluted, and rendered unfit for use in the brewery. The pollution was caused by tarry matter, chiefly water-gas tar, percolating from the defenders' works into the well, through the intervening strata, which dip in the direction of the well. On Feb. 8, 1905, the pursuers raised an action for damages against the defenders; and Lord Ardwall, in June, 1905, found that defenders were the authors of the pollution, and were liable for it. On the footing that the pollution would probably last for ten years, and that the Brewery Well would continue free from pollution, he gave decree for £3730. That decision has been upheld by the Second Division of the Court of Session. The pollution of the Stable Well still continues, in spite of persistent pumping; and the water in it will be unfit for use for many years to come, if it ever becomes good again. In or about the month of February, 1906, the other well in the pursuers' premises—called the Brewery Well—also became seriously polluted, by similar tarry matter emanating from the defenders' works, and percolating through the intervening strata. Since that date, the water in the Brewery Well has also been unfit for use; and the pursuers have been entirely deprived of the supply of water which they previously obtained within their own premises. Subsequent mining operations in the defenders' premises have disclosed the fact that the strata in which the pollution exists are contaminated over a wide area. Owing to the character of the polluting matter, and the extent to which it has contaminated the strata lying between the pursuers' and the defenders' premises, the pollution will be of indefinite duration; and there is no reasonable prospect of either of the wells again becoming useful to the pursuers for brewing purposes. In addition to cleaning and regularly pumping the Brewery Well, it has been necessary, at considerable cost, to obtain a supplementary supply of water from other sources. This, however, is not suitable for brewing, and has to be treated before it can be used. The loss of the Brewery Well, in addition to the Stable Well, has deprived the pursuers of an essential element in their business, to their great loss and damage, and has substantially reduced the value of their brewery to break-up value, and destroyed their business. In any event, the cost to the pursuers, of acquiring and bringing in water from other sources, and treating it so as to make it sufficient for the purposes of brewing, will be very great, and will not be less than the sum sued for.

It is pleaded that, the pollution of the Brewery Well having been caused by the wrongful and negligent action of the defenders, they are liable to compensate the pursuers for the loss and damage thereby sustained by them; that, in any case, the defenders, being the authors of an *opus manufactum*, and having failed to prevent a noxious effluent therefrom from percolating into and polluting the pursuers' well, are liable in damages; and that the sum sued for being, in the circumstances, fair and reasonable compensation for the loss and damage sustained, the pursuers are entitled to decree as concluded for.

Defenders admit that the Brewery Well has become polluted by percolation from their works, and that the water in the well is unfit for brewing purposes; but they say that they have, by mining, located the source of pollution, and have removed it. They have also intercepted the pollution in the strata beneath the gas-works, which is confined to a strictly limited area; and they are in course of cleansing the strata. In consequence of their operations, the pollution has very materially decreased during the short period (about three months) which has elapsed since the defenders located the source of the pollution; and they believe and aver that the pollution is only temporary, and will, in a short time, come to an end. It is admitted that the pursuers have suffered loss through the pollution; but it is maintained that the sum sued for greatly exceeds the loss, and exceeds the total value of the business, even upon the assumption (which defenders deny) that the business has been destroyed.

It is pleaded that, in the circumstances stated, and in respect of the remedial operations which the defenders have executed, and are in course of executing, the action ought to be sisted, to await the result of the operations; that the damages claimed are excessive; and that, in any view, the defenders are entitled to credit for the sum already paid to the pursuers in name of damages.

The pursuers, in reply, deny that the pollution has been removed, and say that, even assuming the defenders have located the point in their ground at which the pollution was introduced—which the pursuers do not admit—the pollution has now saturated the ground to such an extent that it is practically impossible either to remove it or to effectually intercept it. Further, the defenders' operations have been of so intermittent and desultory a character that no reliance can be placed upon their proceeding to remedy it, even if such a remedy were ever practicable.

The case came before Lord Salvesen last Wednesday, for the adjustment of the record. Mr. Horne, for the pursuers, said he wanted

proof; but he understood the other side wished to discuss some points in the procedure roll. The proof he asked would necessarily be a preliminary one, as defenders were carrying out remedial operations.

Lord Salvesen said this and other questions would be very suitable for discussion in the procedure roll. There might be a proof afterwards upon the whole case.

CLAIM AGAINST THE BRADFORD CORPORATION.

Severe Judicial Comments.

Last Friday, at the West Riding Assizes, held in Leeds, Mr. Justice Grantham and a Special Jury had before them an action in which Mr. Albert Rendell, a draper, of Kirkgate, Bradford, claimed from the Bradford Corporation damages for negligence. It was contended that the Corporation workmen took up a flagstone in Albion Court, Kirkgate, for the purpose of repairing a gas-pipe, and replaced it so negligently as to allow water to percolate into the plaintiff's premises.

In opening the case, Mr. E. Tindal Atkinson, K.C. (who, with Mr. J. J. Wright, appeared for the plaintiff), said that in January, 1906, an escape of gas was noticed in the premises of the plaintiff; and there was some trouble in locating its position. A man from the Gas Department was sent for; and after visiting the premises he was led to believe that the escape came from outside. He accordingly went into Albion Court, and took up a flagstone. Eventually, he came to the conclusion that the escape was from the main in Kirkgate; and on this being opened, it was found to be broken. On the morning of Jan. 1, 1907—the day following the fall of a considerable amount of snow—it was discovered that water had come into the basement of Mr. Rendell's premises through the wall. The fixtures of the stationery department were injured; and the goods with which they were stored were ruined. It appeared that the man who took up the flag merely dropped it into its place; and from that time forward nothing had been done to secure it with cement. The aperture left round the stone, down which water could percolate, was considerable—equivalent in area to a space 6 in. by 7 in. At the time of the occurrence, snow had been swept up by the Corporation men into a heap, and put against his client's premises; and it was found that the water was coming through the wall, and was doing a great deal of damage. A message was despatched to the Water Department; and a man who was sent finally located the source of the water to be around the loose flagstone, and said that it should have been cemented. He stated, however, that the matter did not concern his office; and a communication was sent to the Streets Department. But nothing was done to secure the stone; and it was left in exactly the same position as before. As a consequence of the condition of the department of Mr. Rendell's shop where the damage was done, the goods had to be removed into another department; and this seriously interfered with his business.

Plaintiff gave evidence bearing out this statement. In cross-examination, he denied that the flagstone was interfered with by anyone in his employment in October, 1906. The flagstone was never moved at any time by anyone except the Corporation servants. He had a man named Priestley in his employment; but he would swear that he did not take up the flagstone. His carpenter poured tar down the crevices of the stone; but this was after the water had come in. He did not instruct any of his servants to pour water down the crevice before the date of the flood. At the time of the occurrence he had a man named Whittaker in his employ; and he poured some water down the crevice on the instructions of Mr. Robert Broster, a surveyor, who inspected the place after the flood. He denied that he had told his people to throw water over some stock he had bought at a sale. There was at that time a man named Holmes in his service; but Holmes did not under his direction dip a number of cardboard boxes into water after the flood. Holmes resigned the previous Monday, saying he wanted to be a free man. What he meant, plaintiff did not understand. Holmes did not remark that "he was going to tell the truth;" but he did say he could no longer remain with witness, "because the thing was preying upon his mind and his health." Witness arranged with a Mr. Dawson that if the Corporation sent a valuer to value the stock, Mr. Dawson would act for him and settle the matter. The Corporation, however, did not send a valuer. Witness had not himself put any water on his stock. In re-examination, he said that Holmes came to him, and stated that "he could stay with him no longer, because having to give evidence was preying upon his mind."

Mr. R. H. Blackburn, plaintiff's Manager, denied that any attempt was made to increase the damage by throwing water on the goods. Mr. W. Brayshaw, an auctioneer, stated that a quantity of damaged books and stationery were sold for £3 6s. 9d. If they had not been soiled, he thought they would have been worth over £25. Mr. Robert Broster, of Keighley, said that on Jan. 9 he saw the flagstone, and found that it had been removed, and that three of the joints had tar run into them; but there was an open joint ¾ inches wide next to plaintiff's premises. It was not, in his opinion, pitch, but ordinary gas tar, which had been used. He made experiments which rendered it clear to him that there was a connection between the outside of the flag and the inside of Mr. Rendell's premises. These experiments included the putting of a quantity of red ink and water into the hole; and he saw a trickle come into the premises.

For the defence, Mr. W. J. Waugh, K.C. (who had with him Mr. T. R. D. Wright) remarked that he should call witnesses to show that Mr. Rendell gave instructions that things were to be put in among the damaged property which certainly were not damaged by the water which might have come through the aperture. He challenged Mr. Rendell with the fact that Mr. William Dawson, a perfectly respectable valuer in Bradford, had declined to go on with his valuation, expressing the opinion that it was not being honestly conducted; and it was part of the case for the defence that Mr. Rendell had said to another man that Mr. Dawson was not employed because he pretended to be too conscientious. Mr. Rendell's reply to this challenge had been that he denied giving instructions to Mr. Dawson; and he said that Mr. Dawson was not to be the valuer unless another valuer was appointed by the Corporation. But if no other valuer was appointed, it made it all the more necessary that Mr. Dawson should value for Mr. Rendell. It was most significant that Mr. Dawson had retired from the work. People did not nowadays refuse good business unless there was a valid reason for it. The Jury would have observed the way in which Mr. Rendell had given his evidence. They would have noticed that, with respect to the witness Holmes, who had been five years an honest man, Mr. Rendell was suspicious now that he had left his service. He should prove through Holmes that Mr. Rendell gave instructions on this valuation which were not honest, and that things were ordered to be put in which had not been damaged by any water which had come into the shop in the way alleged. He should call a number of other witnesses who would prove that when, in January, 1906, the flag was replaced, it was put back in cement, either the same day or the next day. The cement was brought, put upon the flag, and the work was properly finished off and made perfectly good. At that time, there was no corner broken off the flagstone in question; and he should be able to prove from the evidence of men who were in the habit of cleaning the windows of Mr. Rendell's shop that the flag some time in October had become loose. He should also be able to prove by the evidence of two witnesses that in the month of October Priestley himself took up this flag, and said he was looking for an escape of gas. He put in tar in order to make the flag good; and he should be able to call a man who went to the gas-works for a bucket of tar which was used for the purpose.

A service-layer named Pickles gave evidence that he went to Albion Court, to try and locate an escape of gas. He took up the flag in question, and finding that there was an escape removed some road setts. He then dug down to the main, and temporarily stopped the escape. He put back the earth and the setts and flag in a temporary condition. This was on Dec. 29, 1905. The next day, he finished the repairs to the gas-pipe, and temporarily put back the setts. The flag was laid again, in lime, and pointed up at the joints.

At this stage, Mr. Tindal Atkinson presented as a witness William Priestley, the plaintiff's carpenter, who had been sent for on the mention of his name during cross-examination. He denied that he had ever taken up a flag in Albion Court. Cross-examined, he admitted that last autumn there was an escape of gas, and he made a search for it. But he did not know that on the previous occasion the flag had been taken up; and he did not himself disturb it.

A number of witnesses were afterwards called for the defence. Mr. Charles Wood, the Gas Manager, gave evidence as to the reinstatement of streets after disturbance for repairs; and in cross-examination he said he believed the suggestion of the defence was that the flag stone was taken up for the express purpose of letting water on to the goods. Mr. Waugh, however, denied that such a suggestion had been made to him in his instructions. Mr. William Dawson, replying to Mr. Tindal Atkinson, said he did not know who authorized anybody to state in Court that he had formed the opinion that the claim was a fraudulent one. Percy Fisher and George Hind stated that they saw Priestley with a flagstone up; and Henry Benson (formerly in plaintiff's employ) said he heard Mr. Rendell give orders for the wrappers of goods to be damaged. This witness admitted that he made a statement to plaintiff's Solicitor, to the effect that a man named Whitney introduced himself in the street, and in reply to a question admitted that he represented the Corporation. He asked as to the manner in which the property had been damaged, and witness replied as well as he could. Whitney asked if he had seen Mr. Rendell pour any water or put any envelopes in water. Witness replied: "What a ridiculous question to ask!" Whitney said, "Why should a man set fire to his own shop? Why, to get the insurance money."

The final witness for the defence was Charles Holmes, who was formerly in the service of the plaintiff. He said that some of the goods sent away to be sold by auction were not damaged by the water from Albion Court. Acting on instructions, he wetted some of the cardboard boxes; and plaintiff stuck down some envelopes. The value of some of the stock was put up for the purpose of the case. He made out an inventory of the damaged goods, by order; but this was a false document. Mr. Tindal Atkinson: "So that whichever view is taken of you, you must be a scoundrel." In cross-examination, witness said that he had a long conversation with Whitney; and he gave a statement of the conversation to the plaintiff's Solicitor. He said that on the 8th of June Whitney met him in the street, and asked him if he was Mr. Holmes; and on his replying "Yes," said he was from Mr. Escott, of York. Mr. Tindal Atkinson drew the Jury's attention to the fact that this young man, who was employed in the Legal Department of the Town Hall, represented that he came from Mr. Escott, of York, who was a draper. Reading from the statement made by witness to the plaintiff's Solicitor, Counsel said that after some conversation about Mr. Escott, Whitney said he wanted to talk seriously to witness. He said, "I am from the police, and it is a criminal charge." Witness asked him what it was about; and Whitney said, "This claim that Mr. Rendell is bringing against the Corporation." Witness said, "You represent the Corporation?" and Whitney replied, "No; I am entirely for the police, though the Corporation may pay part of my salary." Whitney invited him to go into a public-house and have a drink; but he declined, though he subsequently accompanied him to the Midland bar, where he had some beer, which Whitney paid for. In conversation there, Whitney asked him, "Have you seen Mr. Rendell slop water about on his goods?" Witness replied, "What a ridiculous question to ask! As if any man would damage his own goods." Whitney said they had strong evidence that this was a got-up claim. Of course, this would be a criminal charge; and there was such a thing as conspiracy. The man who looked over the gate was as bad as the one who was in the field. Whitney asked him if he had arrived at the value of the goods. Witness replied that Mr. Rendell marked all the goods off, and he seldom saw invoices. Whitney warned him that if he gave evidence there would be shorthand writers taking down every word he said, and that his evidence would be used in any other case they might bring. Further questioned by Whitney as to Mr. Rendell's conduct towards his staff, witness said he had found Mr. Rendell a good master, and one who paid him a good salary.

This concluded the evidence; and Mr. Waugh then took a technical objection under the Public Authorities Protection Act that the action

had not been brought within six months of the damage complained of. Mr. Atkinson, in reply, maintained that the damage dated from the incoming of the water, and not from the original act which was the cause of it. The objection was over-ruled.

In addressing the Jury, Mr. Tindal Atkinson said that if the course of conduct which the witnesses had been submitted to were going to be pursued, a great many people would absolutely refrain from bringing actions against corporations. He thought the Jury would agree that it was disgraceful and most discreditable conduct on the part of an official of the Legal Department of the Bradford Corporation to act in the way in which it was shown he had done in this case. It was interfering with the administration of justice and intimidating witnesses—he put it on very high ground, but it was the true ground—and this interference ought to be punished as such. He thought that on the morrow, when the ratepayers of Bradford read an account of the case, they would blush for shame that such conduct could have been pursued by a Corporation official.

His Lordship, in summing up, remarked that the case as it was now presented was a very serious one indeed, because it had brought to light such conduct on the part of one of the most important public bodies—the Corporation of Bradford—as he had never heard of before. Continuing, he said: "We are all accustomed to speak of the tyranny of public bodies in dealing with individuals; but I am very glad to say I do not know that I have ever heard of their being guilty of absolutely dishonourable conduct, as we have heard in this case, and which has been proved up to the hilt. All I can say is that I have very great doubt whether if an application was made to me to commit Whitney to prison for contempt of court, it would not be my duty to send him to prison. I have never heard of such conduct on the part of a paid official." It was, he remarked, a most reprehensible thing for a person in the office of a solicitor to represent himself as being a detective paid by the police, getting up evidence and threatening people as to what would happen if they committed perjury, endeavouring to secure false evidence, then falsely instructing Counsel as to what the evidence they were going to bring forward was going to be, and altogether piling up a case of such dishonourable conduct as it had never been his lot to hear. Of course, now there could be no doubt as to what the verdict would be. Under ordinary circumstances, it would have been his duty to remind the Jury that unfortunately people in making claims often exaggerated those claims; and he should have suggested that the Jury would have been perfectly justified in discounting, and giving something less than, the plaintiff's claim. This was what he had intended at the close of the plaintiff's case to say to the Jury, because it was evident that there was no positive evidence of the exact losses. Now that the evidence had been given, and the conduct of this clerk had been proved, he should think that the only regret of the Jury would be that they could not give double what had been claimed, because it was clear that they could not believe a word of the evidence which had been called for the Corporation. They could not believe one of their witnesses, because where they found that a number of them had been tampered with, they did not know whether they were not all in similar case.

The Jury then returned a verdict for the plaintiff for the full amount claimed, £60; the Foreman stating that he was requested to say by his colleagues that they thoroughly endorsed the remarks which his Lordship had felt called upon to make upon the City of Bradford. He had himself been a business man in Bradford for thirty years, and it had pained him very much indeed. He felt, however, that the remarks had been thoroughly justified.

Judgment was entered against the Corporation, with costs; and Mr. Tindal Atkinson asked for, and was granted, an injunction, as the Corporation had not yet done anything to put the paving-stone right.

A Gas Company to Provide Electricity.

In the Second Division of the Court of Session at Edinburgh, on Wednesday last, the petition of the Shelmorlie and Wemyss Bay Gas Company, Limited, asking authority to the alteration of the Articles of Association of the Company, was considered. The Company was incorporated on Aug. 16, 1876, with the registered office at No. 33, Cathcart Street, Greenock. The capital was £5000, in 1000 shares of £5 each, all of which have been issued, and £2 10s. upon each share paid up. It is now desired to carry on the business of "electrical engineers, electricians, suppliers of electricity, manufacturers of electrical apparatus, and mechanical and chemical engineers; and to generate, produce, and supply light, heat, sound, and power by electricity, galvanism, magnetism, or otherwise; and other business or businesses convenient to be carried on with such business or businesses, or any of them, or any branch thereof; and for these purposes to acquire lands, works, property, and premises wherever convenient, patent rights, and other property." The capital, it was proposed, should be increased to £10,000 by the creation of 1000 new shares of £5 each. There was no opposition to the petition, which was accordingly granted.

Ryde Water Supply.—The Water Committee of the Town Council of Ryde, having completed their arrangements for securing an ample supply of water, recently invited the other members of the Corporation to Knighton, to view the water-works and the improvements made. They visited the engine-house, where much interest was evinced in the process for softening the water. In the course of an address by Mr. F. W. Randall, the Chairman of the Committee, he explained that the works had been undertaken on the advice of Mr. W. Whitaker, and had not entailed any increase in the rates. Alderman Groves, J.P., the ex-Chairman of the Committee, added details as to the work executed during the past ten years, including the laying of a duplicate main at a cost of £5423, providing a new engine and house at a cost of £4545, and ensuring the purity of their supply at a cost of £6200. The Resident Engineer (Mr. J. T. Harvey) was entitled to great credit for his supervision of all that had been done. Much satisfaction was expressed at the works, and a vote of thanks was passed to the Committee.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY AND METER-RENTS.

At the Meeting of the London County Council last Tuesday, the report of the Public Control Committee dealing with the proposal of the Gaslight and Coke Company to re-impose meter-rents [see *ante*, p. 181], came up for consideration.

Mr. Edward Smith asked whether the attention of the Chairman of the Public Control Committee had been called to the statement in the Press that, if this consent were given, at the end of twelve months the Gaslight and Coke Company would be able to charge meter-rents, and also further increase the price of gas.

Alderman H. T. Anstruther (the Chairman of the Public Control Committee) thought it would be difficult to answer a hypothetical question of this kind. He had not seen the statement referred to.

Mr. A. A. Allen, M.P., pointed out that the price of gas, as he understood it, was to vary by the Company in accordance with certain conditions which were laid down; but if they imposed meter-rents, they wanted to know whether the meter-rent would be taken into account in any future variation of the price of gas, or whether the meter-rent would remain. In addition to meter-rent, the price of gas might still go up.

Mr. Anstruther replied that, by the consideration which the Company were willing to give in return for this concession, the Company engaged not to raise the actual price for one year, and to lower the standard price 1d. for all time—effect to be given to this change in the next Act of Parliament. The meter-rent, of course, would remain once the Council assented to it. The Gaslight and Coke Company, loyally adhering to the undertaking which they gave to the Council before a Parliamentary Committee, came to the Council to ask for assent to their re-imposing meter-rents which they had waived some ten or twelve years ago. The Public Control Committee had given the most careful consideration to the question during the whole of one special meeting, and the greater part of another meeting of the Committee, and came to a unanimous conclusion, which was contained in the Committee's recommendation. The questions they had to consider when the matter came before the Committee were, in the first place, whether the Gaslight and Coke Company had good cause for the proposal that they made; secondly, whether the proposal was reasonable in itself; and, thirdly, whether it conflicted with any powers that they had under their Act of Parliament, or with any agreement that they entered into with the County Council. The Committee conceived it to be their duty to see that no undue hardship should be imposed upon any consumer; and they had to inquire whether any valuable consideration was to be given to the consumers in return for the concessions they were requested to make. From the scale of prices submitted by the Company, it would be seen that, on a comparison of the figures furnished by the Comptroller, the majority of consumers of gas under the proposals submitted by the Gaslight and Coke Company would be placed in a better position by the imposition of meter-rents, because it was perfectly clear that the only alternative open to the Company was to impose an extra 1d. per 1000 feet in the price of gas. The Company were not responsible for the rise in the price of coal; and it was perfectly evident that with the increased cost of production, they were entitled to look to some further source of revenue, in order to enable them to supply their customers without actual loss. It was also clear that it was within the Company's statutory powers to re-impose meter-rents, although they gave an undertaking that they would not re-impose them without coming to the Council for consent. To this undertaking, they had loyally adhered; and he might mention that they were very much indebted to the General Manager of the Company for his attendance before the Committee, and his very lucid explanations of the whole bearings of the case. Then they had to consider whether any undue hardship was to be imposed upon consumers. From the table it would be seen that the whole of those who consumed gas by automatic meters were untouched by the Company's proposals; whereas the imposition of an additional 1d., or whatever sum it might be, on the price of gas would undoubtedly have affected them adversely. They were more than 50 per cent. of the whole of the consumers, and might be taken to represent, if not the poorest, at least a very large number of the very poorest classes of consumers. Regarding 3-light meters, it would be seen that the consumers who were supplied by this size of meter were not in quite so favourable a position under the proposal which he recommended the Council to adopt. His inclination, when the matter was before the Committee, was to refer it back, as it were, to the Company; to ask them if they would not be willing to amend their charge of 2s. per annum, or 6d. per quarter, by the reduction of 1d. per quarter, which would bring it to 5d. a quarter, or 1s. 8d. per annum. But, as the matter was rather pressing, and the finding of the Council was to date from Midsummer last, he did not care to do this. He had the assurance of the General Manager of the Company that, if such conditions were imposed, they would be at once accepted by the Company. There only remained the question as to what valuable consideration they were to receive in return; and the Company proposed that, in the first place, they would not raise the price of gas during the current year—that was before Midsummer, 1908; and secondly, they agreed that the authorized dividend under their statutory powers should be calculated upon a price of 1d. per 1000 cubic feet higher than it was at present, the effect of which was to reduce the standard price by 1d. He thought those who had studied the question would realize that, if an agreement to this effect were at once come to, and an undertaking obtained that this provision would be inserted in the very next Act of Parliament the Company secured, it could be conclusively proved that a permanent benefit had been secured to the consumers of gas in London.

Mr. I. Salmon expressed the opinion that the proposal was the fairest for all classes of consumers, with the exception of those using the 3-light meter, who suffered to the extent of nearly 5d. What

principally influenced the Committee in coming to a decision was that 261,000 automatic meters were used by the working classes who took their supply from the Company; and if the price of gas were increased by 1d. per 1000 feet, they would pay not only the increased price, but would still be paying meter-rent, because, under the Special Act upon which these charges for automatic meters were made, they paid a meter-rent of 9½d. per 1000 feet. He moved, as an amendment to the recommendation, that the following words be inserted after the word "submitted" on line 2, "except that the annual meter charge for 3-light meters shall not exceed 1s. 8d. and."

Mr. CYRIL S. COBB seconded the amendment.

Mr. EDWARD SMITH desired the Chairman of the Public Control Committee to give a statement that his hands would not be tied when the Company went to Parliament for their next Bill. The City paid no meter-rent. By a Special Act of Parliament they were excluded from such a charge. It was a very complicated matter; and he wished there should be preserved to the Council full liberty to take any action to attempt to remove this restriction whenever the Company should go to Parliament, in compliance with the undertaking he understood they had entered into. This assurance being given by the Chairman, that they were entirely free not to still further perpetuate this side of the matter, he did not know that he should oppose it. By passing a thing like this hurriedly, affecting one particular class, they might inflict very great injustice upon another, and an equally important, class of the community. He therefore suggested to the Chairman of the Public Control Committee, that he should allow it to stand over until they got an undertaking on the part of the Company.

Mr. ALLEN said they were specifically told that it was necessary for the Company to increase their income. They seemed to be going about the increase in rather a curious manner, because they desired to charge a meter-rent which was the equivalent of ¾d. per 1000 feet on the price of gas; and in exchange for this they were going to raise the bar under which they got it passed before, which could increase their dividend by 1d. per 1000 feet. It seemed to him that, so far from getting any benefit out of it—charging ¾d. in this particular manner—they were putting this extra 1d. bar before they could increase their dividend.

Alderman W. S. SANDERS said when a company looked as if they were giving away something, he got very suspicious. It seemed to him that the Company wanted to get an increase of dividend, and a permanent increase of dividend, in a way that would not call the public attention to the increase as an increase in the price of gas would. Whether the consumer suffered immediately or not, he believed the most straightforward way, if the Company wanted to make more dividend, would be to put up their price for gas, because although apparently the consumer would not suffer the first year, he wanted to know the effect of these charges in the future. It seemed to him what the Company wanted was to have a minimum of income which would not be variable—that was to say, they could always depend upon £60,000, which would never vary except in an upward sense. If there was going to be a variation, let it be a true variation all round; let the people know what they had to pay for their gas in the future, as much as they knew in the present year.

Alderman ANSTRUTHER accepted the amendment of Mr. Salmon and Mr. Cobb, because it gave effect to an undertaking which he had been able to secure in negotiations with the Company. On the question raised by Mr. Sanders, he did not know that he had fully appreciated the position. As it appeared to him (Alderman Anstruther) no increase in the dividend could be arrived at, as determined by the standard price—the sliding-scale above and below the standard price—without a reduction in the price of gas; and therefore it could not be truly said that the object of this action on the part of the Company was merely to increase their dividends. Their object, as he understood it, was that the Company should place themselves upon the same footing as other gas companies in London, who were in the position of charging meter-rents, in order that their price to consumers might not compare unfavourably in their published statistics and balance-sheets and so forth which was available to the people of London. So far as the ultimate or possible increase, after the termination of the year 1908 was concerned, the Council would understand that the undertaking that the Company were giving them, to raise the point on which their dividend should be calculated, was one that was to be for all time; and the engagement not to increase the price of gas was only in operation for one year. The fact that the City was excluded weighed with some of them when they first came to consider this question in the direction of advising the Council to refuse the application of the Company, in order that every citizen of London might be put upon the same footing; and this point was discussed by the Public Control Committee. No reference to it was made in the report, because they did not consider it to be their duty to go beyond the immediate question which was submitted to them for consideration. He had an assurance from those who were responsible for the management of the Company that, upon the next occasion that they went to Parliament, it was their intention to ask for powers to place the whole of the consumers, whether they be in the City of London or in the County of London, upon the same footing.

The CHAIRMAN put the amendment to the Council; and it was agreed to.

Sir J. W. BENN, M.P., then moved that the report of the Committee be referred back. It had been explained that this was merely a re-adjustment of prices in order to enable the Company to take their place side by side with other gas companies; but he was a little bewildered, because it said "The Company now states that, in consequence of the recent increase in the price of coal and oil, it is faced with the necessity of increasing its income, and one way which suggests itself is the re-imposition of this rent." He thought it was quite clear from this that somebody had to pay an additional sum. He could not fully understand the matter; and for the purpose of getting more light on the subject he moved that it be referred back.

Mr. ALLEN seconded. It was a somewhat difficult report to understand. So far as he could make out, the alternative seemed to be the imposition of meter-rents or the imposition of an additional 1d. per 1000 cubic feet on the price of gas. They were told that for every additional 1d. of price per 1000 cubic feet of gas the consumers would have to pay something like £80,000 per annum. This meter charge, which was equivalent to ¾d. per 1000 cubic feet of gas, would produce only £60,000. Then also, in addition to the meter-rent, the Company would be getting a larger charge for the gas they supply on the south side of the Thames.

Alderman ANSTRUTHER said without any reference to them at all, the Company had this power already. They equally had the power to increase the price by any sum that they pleased on the north side of the river.

Mr. ALLEN said that they would, in fact, get rather more than 1d. extra per 1000 cubic feet. The matter was so extremely difficult that he could not believe a Company of this kind were bringing up the recommendation with no object of serving their own ends. He did not in the least see where the interests of the consumer came in.

Sir JOHN M'DOUGALL said the practical result would be that there would be a special charge for meter-rent in every case. Supposing this were 2s., if somebody had to pay 1s. 6d. as an increased charge for gas, he would not be nearly so troubled and annoyed as having a new charge of 3s. put upon him. The Company would say "Oh, yes, this has been done with the consent of the London County Council." The Company had for some reason or other agreed not to make a meter charge. Now they were going to assent to them doing it. It would cause commotion among every one of the people that the London County Council were putting on a new charge. They ought to leave the Company to go to Parliament, and the Council should not forego something the Company assented to do some time previously.

Alderman ANSTRUTHER deprecated the reference back of this question. He did not believe that any further light could be shed upon the matter a week hence. With regard to what Sir John M'Dougall had said, he admitted at once that his first impression was to take his view, because it was absolutely open to the Company to-morrow to put up the price of gas 1d.; and if they could stand the racket of the lower dividend, to put it up by 3d. per 1000 feet. But after the most careful consideration, the Committee were unanimously of opinion that the easier method for the consumers, and particularly for the great body of the poorer consumers, especially automatic consumers (amounting to over 50 per cent. of the customers of the Company), was to waive their right to prohibit as it were the imposition of the meter-rent, as it would be easier from the point of view of means and substance of the poorer consumer.

On a show of hands, the reference back was lost; and the amended recommendation of the Committee was agreed to.

THE PAST YEAR AT MANCHESTER.

Another Satisfactory Increase in Gas Consumption.

We have received from Mr. Charles Nickson, the Superintendent of the City of Manchester Gas Department, the report and accounts of the Gas Committee for the year ending March 31; and from them the following particulars have been gathered. The report bears the signature of Alderman R. Gibson, the Chairman of the Committee.

The quantity of coal and cannel carbonized (including the equivalents of enriching materials) was 503,693 tons, as compared with 484,249 tons in the previous year; the quantity of gas made per ton being 11,099 cubic feet, against 10,976 feet. The quantity of gas sent out from the works (5,589,906,000 cubic feet) shows an increase of 270,071,000 feet, or 5·08 per cent., as compared with an increase of 321,379,000 feet, or 6·43 per cent., the preceding year. The quantity of carburetted water gas produced during the year was 1,191,215,000 cubic feet, as compared with 1,194,041,000 cubic feet the previous year. In the production of this gas 2,930,081 gallons of oil and 24,526 tons of coke were used, as against 3,531,282 gallons and 22,917 tons respectively for the year ending March, 1906. The illuminating power of the gas sent from the works, as tested by the "Metropolitan" No. 2 burner, was equivalent to 17·67 standard sperm candles. The unaccounted-for gas was 3·14 per cent., which compares with 3·20 per cent. for the previous year.

The number of consumers on March 31 was 166,061, of whom 21,017 were outside the city. The previous year the number was 160,113, of whom 19,389 were outside the city. The total increase was thus 5948. Of the total consumers, 54,705 use prepayment meters. This compares with 52,006 in the previous year—an increase of 2699; and of this increase 2087 have been fixed in the city and 612 in the out-townships. The quantity of gas passed by these meters was 474,582,000 feet, an increase of 47,750,000 feet, or 11·19 per cent., on the previous year. The meters have been inspected once in every five weeks; and the amount collected during the year was £66,530 13s. 3d. This is represented by 15,967,359 pennies, weighing 142 tons 11 cwt. 1 qr. 7 lbs. The number of gas-cookers and other appliances owned and fixed by the Committee at March 31 was 36,214, compared with 29,760 for the year ending March, 1906. The total quantity of gas that was consumed by cookers is estimated at 504,000,000 cubic feet—being an increase of 78,000,000 feet, or 18·31 per cent., on last year's figures. There have also been fixed 28,452 grillers in connection with prepayment and small ordinary meters. About 39 per cent. of the consumers now have the free use of a cooker or griller. On March 31 last the number of gas-engines in use was 1732, as compared with 1775 in the previous year. The quantity of gas consumed by these engines was 416,227,000 cubic feet—an increase of 2,138,000 feet, or 0·51 per cent. The cost of coal, cannel, and oil per ton carbonized was 9s. 11·81d., as against 10s. 4·74d. for the previous year, a reduction of 4·93d. per ton, which, on the total carbonization of 503,693 tons, amounts to £10,347.

The total income was £730,902, against £699,566, and the expenditure £564,304, against £566,692. The gross profit on the year's working was £166,598. The sum of £46,474 was paid for interest on loans, &c. The net profit therefore amounted to £120,124, as compared with £90,004 in the previous year. This sum, together with £8782 transferred from reserve—making together £128,906—has been appropriated as follows: To the sinking fund for redemptions of loans, £56,111; paid over to city fund, £60,000; extension of carburetted water-gas plant, £17; extension of the Whitworth Street West depôt, £2518;

Gaythorn works (land), £318; general extensions (wages), £8655; purchase of consolidated 4 per cent. stock for cancellation, £1286.

During the year the horizontal retort settings in the second section of the No. 2 retort-house at the Gaythorn station, together with the building and the river covering, have been removed to make way for the completion of the installation of inclined retorts. A section of water-sealed purifiers, consisting of eight boxes, erected forty years ago, with an area of 3600 square feet, have been removed and replaced with four rubber-sealed purifiers of an area of 7500 square feet. A new installation of West's compressed-air stoking machinery in the "B" and "C" retort-houses at Rochdale Road has been completed, and is working satisfactorily. Various other alterations and extensions at the different works have also been taken in hand. The total length of mains now laid is 1,581,261 yards, or 898¼ miles and 341 yards; being an increase of 18¾ miles and 360 yards during the year. The number of public lamps within the city is 18,139, and outside the city 2224—a total of 20,363, of which 14,514 within the city are fitted with 20,976 incandescent burners.

The following are the principal items in the accounts:—

REVENUE ACCOUNT.

INCOME.

Gas-rental—		
Ordinary meters		£492,349 2 3
Prepayment meters		66,530 13 3
Public lamps		42,681 16 9
Residual products—		
Coke	£66,924 13 5	
Tar	26,897 3 3	
Sulphate of ammonia	34,388 13 10	
Carbon	331 6 1	
		128,541 16 7
Rents of cottages, &c.		798 15 11
		£730,902 4 9

EXPENDITURE.

Manufacture—		
Cannel, coal, and oil (including cost of unloading, &c.)	£251,460 9 1	
Coke, water, &c. (carburetted water gas)	8,906 4 6	
Carbonization (wages)	45,607 6 0	
Purification (less sales of spent material, £4791 13s. 9d.)	2,898 17 0	
Retorts, fire-bricks, &c.	6,115 11 10	
Repairs and maintenance of works, &c.	41,644 17 9	
Salaries of Engineer and works staff (less proportion transferred, £1240 9s. 4d.)	5,922 14 8	
	£362,556 0 10	
Provision for renewal of works plant	20,127 0 0	
		£382,683 0 10
Distribution—		
Repair and maintenance of mains, services, meters, and stoves	£33,758 3 4	
Salaries (less proportion transferred, £300)	27,255 9 5	
	£61,013 12 9	
Provision for renewal of distribution plant	41,821 0 0	
		102,834 12 9
Rents, rates, and taxes		55,174 8 7
Management—		
Salaries	£15,139 14 1	
General charges	4,875 9 9	
		20,015 3 10
Law and parliamentary charges		130 0 0
Subscriptions and donations		2,222 4 1
Bad debts		1,244 5 5
		£564,303 15 6
Balance carried to profit and loss account		166,598 9 3
		£730,902 4 9

The accounts are followed by the usual appendices, furnishing particulars in regard to the progress of the undertaking.

Appendix A is a comparative statement of the gas transmitted from the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows:—

	Daytime. Cubic Feet.	Twenty-four Hours. Cubic Feet.
Year ended March 31, 1907	1,779,779,000	5,589,906,000
Do. Do. 1906	1,670,277,000	5,319,835,000
Increase	109,502,000	270,071,000

	Cubic Feet.
Gas transmitted from the works	5,589,906,000
Do. accounted for	5,414,446,000
Loss (by condensation and leakage)	175,460,000
	or 3·14 per cent.

In Appendix B, particulars are given as to the results of the working from March 31, 1888, to March 31, 1907. The table contains statistics as to the number of tons of coal and cannel carbonized, the total make of gas, the percentage unaccounted for, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., each year in the above-mentioned period. The particulars for the past financial year are as follows: Coal and cannel carbonized, 503,693 tons; gas made, 5,590,460,000 cubic feet; yield per ton of coal carbonized, 11,099 cubic feet; illuminating power, 17·67 candles; quantity sold, 5,277,615,000 cubic feet; quantity sold per ton, 10,478 cubic feet; percentage of output unaccounted for 3·14; coke for sale, 199,133 tons; do. per ton of coal, 10·05 cwt.; make of tar, 26,918 tons; do. per ton of coal, 11·54 gallons; ammoniacal liquor (10-oz. strength), made, 11,303,378 gallons; do. per ton of coal, 28·53 gallons; sulphate made, 4021 tons; do. per ton of coal, 24·50 lbs.

Appendix C shows the number of stoves and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 30,705 stoves on hire within, and 5509 beyond, the city—together 36,214, compared with 25,078 and 4682 (together, 29,760) at the corresponding date in 1906; so that there was an increase of 6454. The number of meters in use was 166,061 in 1907 and 160,113 in 1906. There was last year a net increase of 5948 on the number for the preceding year. The number of prepayment meters in use on March 31 last was 54,705—an increase of 2699 on the number at the close of the preceding year.

From Appendix D, we learn that the gas-mains laid last year within the city extended to 30,311 yards, and beyond the city to 11,672 yards—being 23¾ miles and 183 yards. The mains taken up were 8011 and 1492 yards respectively—a total of 9503 yards, or 5¼ miles and 263 yards. The total net increase during the year, therefore, was 32,480 yards, or 18¾ miles and 360 yards. The total length of mains at March was 1,581,261 yards, or 898¼ miles and 341 yards.

Appendix E is an abstract of the capital, revenue, and profit and loss accounts. It shows (*inter alia*) the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from March 31, 1887, to March 31 last. The figures for the past financial year are as follows: Gross profit, £167,950; net profit, £120,124; contributed to sinking fund for redemption of debt, £56,111; paid over for improvement purposes and city fund, £60,000; applied in extension of works, £12,796; borrowed money owing, £1,235,295; and excess of assets, £1,537,417. From June 24, 1843, the date when the works were taken over by the Corporation from the Commissioners of Police, the gross profits on the gas undertaking have amounted to £5,753,609, out of which £1,365,946 has been paid for interest—leaving a net profit of £4,387,663. Of this total, £1,346,505 has been placed to the sinking fund, £2,479,383 has been handed over to the Improvement Committee and added to the city fund, £329,201 has been paid for street lighting (making £2,808,584 used in relief of the rates), and £183,434 applied to extensions of works.

EXTENSION OF THE HARROW GAS-WORKS.

Compensation for Land and Property Acquired.

On Wednesday last, a claim against the Harrow Gas Company, for compensation for disturbance, came on before the Under-Sheriff of Middlesex and a Jury at the Guildhall, Westminster.

Sir EDWARD BOYLE, K.C., M.P., and Mr. DENNISS represented the claimant (Mr. Hall, dairyman and farmer, of Harrow); Mr. BALFOUR BROWNE, K.C., and Mr. PADDON appeared for the Company.

Sir EDWARD BOYLE, in opening, intimated that the claim was in respect of Eastcroft Farm, Harrow—a freehold of about three acres, with farmhouse and buildings and several cottages upon it. The farm adjoined the property of the Gas Company, who, requiring to extend their works, had taken compulsory powers to purchase the claimant's holding under a recent Act of Parliament. Mr. Anthony Hall, the claimant, in addition to being the freeholder of Eastcroft, also rented 109 acres adjoining the farm, for the purposes of pasturing cows, &c. He had been tenant of the land for thirty years; and though his lease was up on Sept. 2, 1908, there was no doubt that he would be again accepted as a tenant. In 1900, the claimant sold the Gas Company a piece of land adjoining their works at the rate of £1000 an acre, and, in addition, Mr. Hall reserved a strip of frontage adjoining the Gas-Works lane. They also built a substantial boundary wall, and further agreed to drain the lane. He mentioned this as an indication of the value of the land surrounding. To-day there was a station near. The land was ripe for building purposes, and was becoming daily more valuable. The claimant kept 50 or 60 cows, and made £1000 a year out of his business, which, during the last five or six years, had increased to the extent of 50 per cent. in consequence of the rapid growth of the district. If claimant was deprived of his farm and buildings, the land he rented would be no use to him. He would have to dispose of his business, and thus sustain very considerable loss. The rental of the freehold house and farm buildings, together with five cottages and land, was estimated at £156 per annum, which, at 20 years' purchase, was worth £3120. Then there was about three-quarters of an acre adjoining the gas-works (which they valued at the rate of £1000 an acre), £681. There was also the strip of frontage to the Gas-Works lane, £100; for fixtures, £26 7s. was claimed; enforced sale of stock, &c., £524; and other minor things made the claim under the item of the farm, £5006. In consequence of the sale of the farm, claimant would lose his business; and for this he asked three years' purchase, at the rate of £1000 per annum profit, £3000—making the total claim just over £8000.

Mr *John Strachan*, the Clerk to the Harrow Council, was called, and gave evidence as to the development of Harrow. In 1901 the area of Harrow was 1000 acres, and the population numbered 5725; in 1901 it had increased to 10,220, and the area to 2197 acres. In 1906 the population was 13,697; and they estimated it now at 14,000.

By Mr. BALFOUR BROWNE: The area had been doubled at the same time as the increase of population indicated.

Mr. *W. Flint*, a surveyor, stated that he had examined the property of the claimant, and considered the land valuable for building purposes. He valued the farm and adjoining buildings and cottages at a rental of £156 per annum, which, at twenty years' purchase, gave £3120; freehold building land between the house and lane adjoining (2 roods 29 poles), £681; a strip of frontage, 150 ft. by 4 ft. 9 in. average width, £100—total £3901. Add 10 per cent. for compulsory sale, £390; grand total, £4291. Loss on 109 acres rented, half-year's rent £164 5s.; loss for forced sale of stock, £275, trading utensils, &c., £149 15s., loss on hay, &c., £100, total £524 15s.; loss on having to sell the business, £3234—making a total of £8240. He was of opinion that if the farm was taken, claimant would be unable to carry on his

business, and would have to dispose of it. The land he rented would be of little value to him without the farm, which was essential for his business. Claimant would be unable to find suitable land for his cows anywhere near, on account of it being held for building purposes.

In cross-examination by Mr. BALFOUR BROWNE, witness said that when the farm was taken from claimant there was plenty of other land in the district to be sold, but it was for building on. It was very expensive to buy such land for dairy purposes. The area of the claimant's freehold land was 2 acres 2 roods 29 poles; and he considered the taking of this would spoil his business. He knew that the claimant had recently purchased another farm in the district; but it was 1¼ miles from the existing one, and was unsuitable for dairy purposes. He was aware that when the Company gave £1000 an acre for the previous plot of land, they had not any compulsory powers. He thought the strip of frontage worth something. He might build a high wall on it. As the place developed, this might make an advertising station. If the lane were deducted from the area of land, it would make no difference to his valuation. He thought the piece of land adjoining the site belonged to Mr. Chapman, who was "someone in connection with the Gas Company."

Mr. BALFOUR BROWNE: Supposing we reinstate you on the land adjoining the site, all your claim for loss of business goes, does it not?

Witness: If they reinstated claimant.

In further examination, witness said, in his opinion, it would take £1000 to reinstate claimant in so far as the farm buildings were concerned, without considering the farm and cottages. The latter were of wood; but he had valued them at twenty years' purchase.

Mr. *Howard Martin*, an auctioneer and surveyor, gave similar evidence; and his estimate of the value was £7701.

After an adjournment,

Sir EDWARD BOYLE announced that the parties had arrived at a settlement. The Company had agreed not to take the whole of the land at once, thereby giving his client an opportunity of realizing his stock at the end of his lease of the 109 acres of land he was now renting, the lease of which was up on Sept. 29, 1908; and his clients had agreed to accept a verdict of the Jury for £4500. Of this sum, £2000 was to be paid at once, and the remainder on the completion of the purchase.

Mr. BALFOUR BROWNE: On proof of title?

Sir EDWARD BOYLE: That is usual.

A verdict was returned accordingly, costs to follow the event.

INSURANCE OF GAS-WORKS EMPLOYEES.

Report by Mr. W. R. Herring.

In accordance with instructions, Mr. W. R. Herring, the Chief Engineer and General Manager to the Edinburgh and Leith Corporations' Gas Commissioners, has presented a report to the Commissioners on the subject of their liability under the Workmen's Compensation Acts. The point specially considered by Mr. Herring was whether it would be advantageous for the Commissioners to insure their workmen with some recognized association to cover all claims at common law or under the Employers' Liability Acts or the Workmen's Compensation Acts; or, on the other hand, to continue to follow the policy which has been practiced during the past ten years, of meeting all claims arising under such Acts out of the current revenue. The practice hitherto followed in dealing with employees who have had the misfortune to meet with an accident is to pay half wages from the time of the accident happening, notwithstanding the fact that there was no obligation under the Workmen's Compensation Act to take into consideration the first fourteen days of such accident. The new Act, however, provides that no compensation shall be payable in respect of any injury which does not for one week disable the workman from earning full wages. If incapacity, however, lasts two weeks or more, the liability is from the date of the accident, and does not exceed 50 per cent. of the former wages. Mr. Herring prepared a table setting forth the total wages paid during the past ten years, the amount paid as compensation for accidents for each year from the time of the accident happening, the rate per cent. of wages that the sums paid came to each year, and the maximum and minimum number of employees during the winter and summer months, accompanied by remarks relating to particularly bad accidents recorded against any year. By totalling the claims, he showed that the compensation paid under the Acts amounted to £1114 5s. 3d., or an average of 2s. 9d. per cent. of the wages paid. The recent amendment to the Workmen's Compensation Act brings an additional number of the employees within its scope, totalling 180 above those recorded in the table. After offering some remarks in regard to the question of the liability of gas-works employees who meet with an accident, and pointing out that the Commissioners' employees do not run any unusual risks, he came to the conclusion that, in view of the fact that the rate at present asked for insurance of gas-works employees is 17s. 6d. per cent. of wages, and 12s. 6d. for some others, such as meter readers, &c., whereas it has only cost, during the past ten years of somewhat exceptional circumstances, 2s. 9d. per cent. of wages paid, the Commissioners will be wise to continue in the future as they have done in the past, and bear the burden, and meet out of the current revenue from year to year any claims arising as the result of accident.

Water-Works Scheme for Birr.—Mr. A. G. Price, Engineering Inspector of the Local Government Board, last Tuesday held an inquiry into an application by the Birr Urban District Council for a loan of £10,200 for the purpose of carrying out a scheme of water-works for the town. It transpired that the War Office had agreed to take a supply of 15,000 gallons a day for the barracks at Crinhle, for a period of fifteen years, at the rate of 10s. 6d. per diem. Mr. Francis Bergin, Engineer to the Council, estimated the number of gallons that would be required per day at 110,000, and the total cost at £10,195.

EUROPEAN GAS COMPANY, LIMITED.

An Increased Bonus—Changes in Works' Management.

The Annual General Meeting of the Company was held last Tuesday, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. R. HESKETH JONES in the chair.

The SECRETARY and GENERAL MANAGER (Mr. W. Williams) read the notice convening the meeting, and afterwards the Directors' report and the accounts. The former was as follows:—

The consumption of gas during the past year shows, in the aggregate, the satisfactory increase of 3½ per cent. With the exception of Caen, all the Company's stations have shared in this increase, which was largest at Boulogne, Rouen, and Sotteville (6 to 9 per cent.), and varied from 2 to 4 per cent. at Bolbec, Amiens, Havre, and Nantes.

The returns from coke, tar, and sulphate all show an improvement; and there has been no advance in the cost of coal—the supply having been assured under contracts made two years ago. In making new contracts, however, the Board, in common with the Directors of all other gas undertakings, have had to submit to higher prices.

Reference has been made in recent reports to the increasing business of the Company at Nantes, where the Company's concession runs until December, 1946. Having regard to possible future requirements there, the Directors have taken advantage of a favourable opportunity to purchase some property adjoining their gasholder station. It includes land and buildings which, later on, will doubtless prove a useful acquisition to the Company.

The unexpired concessions for the seven towns lighted by the Company average 28 years.

The satisfactory state of the Company's business and of its prospects generally, appeared to the Directors to warrant an increase in the interim dividend. Accordingly the shareholders received on Feb. 1 last a dividend of 5 per cent., instead of the usual 4 per cent. which had been paid for many years past. The Board propose to maintain the dividend at the same rate as in previous years, but to declare a bonus of 2 per cent., instead of 1 per cent.—thus increasing the total return to the shareholders for the year by 1 per cent. The Directors therefore recommend the payment of a dividend of 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, less the interim dividend of 10s. and 7s. 6d. per share respectively paid on Feb. 1 last; also that a bonus of 2 per cent. be paid on all shares according to the amount paid thereon, subject, however, to a deduction for French stamp and transfer duty of 1s. 1d. per fully-paid share, and 10d. per share £7 10s. paid, in respect of all shares held in France.

Notice has been given that two Directors (R. Hesketh Jones, Esq., and H. E. Jones, Esq., M.Inst.C.E.), and both Auditors (J. Reeson, Esq., and A. T. Eastman, Esq.) retire from office at this meeting; but, all being eligible, they offer themselves for re-election.

The CHAIRMAN, in moving the adoption of the report and accounts, said he did not intend to detain the shareholders but for a few minutes, for the satisfactory state of the accounts and report which had been read must be as gratifying to them as they were to the Directors. One might say that the year under review had been a "record year," and had enabled the Board to write down the Company's investments and many other items very liberally, thus relieving the finances of future years, and so providing, as it were, for at least some portion of the future increased cost of coals. One might also venture to state that the Directors saw no reason why this year's rate of dividend and bonus should not be maintained for the year ending March 31 next. It might be mentioned that the 2 per cent. bonus was not paid out of the manufacturing profits, but represented the dividends received on the investments of the reserve and redemption funds. On March 31, there were 73,139 consumers on the Company's books, spread over 534 miles of mains; being an increase of 2613 consumers and of 10 miles of mains, thus showing the progressive character of the Company's business. Although his remarks were few, it must not be thought that there had been no troubles to meet during the year; but thanks to their General Manager and to the Managers of their several works, the difficulties, as they had arisen, had been surmounted without friction either with the workmen, the consumers, or the several governing authorities in France. At the present time, it might be said that they were living in peace, and their endeavours would be to maintain amicable relations with all with whom the Company might have to deal. There was one matter to which he might allude, and which did not pertain to the period under review. For some months past, the health of M. Marchal, their esteemed Manager at Nantes, had been failing. The importance and development of the business there rendered it necessary to have, not only a devoted and skilled Manager, but one whose bodily health was good. M. Marchal, feeling this, had just resigned, and had this month been placed on the pension list. He was succeeded by M. Gustave Gautier from Rouen, one of their most experienced Managers. This has necessitated changes in management at Rouen, Boulogne, and Amiens, which were in course of being carried out. It was satisfactory to know that these changes could be effected without going outside their own technical staff. He concluded by moving that the report and accounts be received and adopted.

Mr. E. FELIX WHITE seconded the motion.

Mr. H. A. RIGG remarked that he noticed part of their investments were in South Nigeria stock. Was that a stock guaranteed by the British Government?

Mr. H. C. SMITH said it was not. The security, however, was good; it was a Crown Colony, and the stock a trustees' investment.

The motion was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. N. E. B. GAREY, a dividend and increased bonus, as recommended in the Directors' report, were declared.

Mr. JOHN COPPEN proposed, and Mr. H. E. JONES seconded, the re-election of the Chairman as a Director. This was agreed to; and a further resolution, moved by the CHAIRMAN, and seconded by Mr. GAREY, also returned Mr. H. E. Jones to the Board.

Mr. H. E. JONES, in the course of his acknowledgment, said he should like to say that the question of the investment of the Company's funds was a matter of very grave discussion on the part of the Board; and they almost invariably sought trustee investments, such as, while they did not give them the fattest return, gave them absolute security.

The retiring Auditors (Mr. J. Reeson and Mr. A. T. Eastman) next came up for re-election. The former was proposed by Mr. GOLDSMID

and the latter by Mr. RIGG; and Mr. E. F. DONNE seconded both. The propositions were unanimously carried.

The CHAIRMAN moved that the thanks of the meeting be passed to the officers and staffs in London and abroad. He spoke of Mr. Williams as an admirable officer—very cautious and very much attached to the interests of the Company; and with reference to the other members of the staff in London, he said he could not speak too highly of them. Regarding the staffs abroad, he thought the fact already mentioned that, in making their re-arrangements for the management of their works, it was not necessary to go outside their own staff for officers for the vacancies, was high testimony to the ability of their technical staff. To speak of anyone of them individually would be perhaps invidious on his part, because all their officers were most efficient in their management and tact.

Mr. H. E. JONES said that he had the greatest pleasure in seconding the vote, because the staff of the Company was filled, in its most important places, by men of education and experience. Especially was this so of the engineering staff. Their men were trained in engineering, apart from gas engineering, before they came to the gas department; and they worked in a most conscientious manner. In fact, having to do with a few gas undertakings in this country, he often said he wished there was the same scrupulous care here over the small details, particularly in the matter of residuals. The precision and care with which every small thing was turned to account was most remarkable; and to the different matters of extension from the engineering point of view, there was devoted not only competence, but great care and study. It was, indeed, a pleasure to see a staff so efficient. He should like to say, too, with what personal regret he had learned of the retirement of M. Marchal, who, though failing in health, was one of the most competent and energetic gas engineers he had ever met with.

The motion was heartily agreed to.

Mr. WILLIAMS expressed his great appreciation of the vote, which, he said, would be equally, especially at the present time, appreciated abroad. They had made changes at four of their stations; and each Manager would try, though he would have a difficulty, to do better than his predecessor. They would, he knew, all do their best; and the changes would, if anything, he was quite certain redound to the benefit of the Company.

Mr. H. D. ELLIS remarked that a vote of thanks, which was most excellently deserved, had been passed to their "lower house," represented by their Managers and their staffs; and it was his pleasure to propose, and he knew this would meet with the approbation of the shareholders generally, a vote of thanks to their "upper house," represented by their Chairman and his colleagues. In another place, the Upper House now and then came in for some hard knocks; but here there was nothing but praise and congratulation for the "upper house." Their Company was one of the best managed with which he was acquainted.

Mr. COPPEN seconded the motion; and it was at once unanimously carried.

The CHAIRMAN, in acknowledging the vote, said he could assure the shareholders that in this Company it was not such an arduous duty to conduct the business as it was in some cases where there were crooked ways abroad, and where matters did not go so smoothly as with their own Company. At the same time, the Directors had their anxieties, involving thought and care; and it was indeed a great pleasure to find not only that their officers agreed with them, and accepted what the Directors dictated and advised, but that what was done was appreciated by the shareholders.

This concluded the proceedings.

ANNFIELD PLAIN GAS SCHEME.

At the last Monthly Meeting of the Annfield Plain Urban District Council, a report was presented by the deputation that attended the proceedings on the Annfield Plain and District Gas Bill in both Houses of Parliament.

The report stated that, as originally drafted, the Bill was open to very great objection on many points; but before any expenditure was incurred in opposing, a meeting was arranged with the promoters, who are the present owners of the gas-works at Kyo and Dipton. The chief points to which objection was taken were: (1) The large amount of capital proposed to be raised; (2) the inclusion of the areas of Tanfield and Medomsley; (3) the standard rate of dividend, 10 per cent.; (4) the standard price of gas, which was 4s. 3d. per 1000 cubic feet, with a sliding-scale; (5) the arrangements under which the promoters were to sell the gas undertaking to the Company to be incorporated under the Bill. When the Bill left the House of Commons Committee, several alterations had been made. The parish of Medomsley, which was already included in the area of the Shotley Bridge Gas Company, was struck out; the standard price of gas was reduced from 4s. 3d. to 4s. per 1000 cubic feet; and the capital was lowered to £48,000, as against £60,000 originally proposed. The Council decided to carry their opposition to the Lords; the main ground of their petition being that the Bill, as it left the Commons, would enable the promoters to claim a large sum for goodwill and prospective value. Their Lordships upheld the contention of the Council on this point, and decided that the price to be paid the promoters by the new Company should be the actual price paid by the promoters, *plus* the value of any work executed since the purchasing of the undertaking by the promoters; the value of the added works to be ascertained by an independent arbitrator. The opposition to the Bill had therefore resulted in the following advantages: (1) The reduction of the standard price of gas by 3d. per 1000 cubic feet; (2) the reduction of the standard rate of dividend by 3 per cent.; (3) the arrangement for the sale of the gas undertaking to the new Company, by which the Company is saved from all liabilities for sums representing goodwill and prospective value. The arrangements meant a large yearly saving to the gas consumers of the district.

INSPECTION OF FACTORIES AND WORKSHOPS.

Further Extracts from the Report of the Chief Inspector.

At the close of the notice of the last report of the Chief Inspector of Factories and Workshops which appeared in the "JOURNAL" last week, it was mentioned that it included reports by the Lady Inspectors and the Electrical and Medical Inspectors. These contain matters which it may be of interest to reproduce.

Miss Power sent to the Principal Lady Inspector (Miss A. M. Anderson) a summary of the reasons for having free ventilation in workrooms—laying special emphasis on its importance in places where gas is supplied for lighting, heating, or motive power. She supports the contention as to the insidious effect on health of slow contamination of the air by leakages of coal gas with the authority of Professor J. Lorraine Smith and Dr. Corfield, and reminds her Chief that it is a matter of general experience that gas-fittings tend to leak from time to time, and the consequent escape of unburnt gas is familiar in its unpleasantness, though difficult to locate. It may arise from the fittings of stoves, burners, kilting-machines, gas-irons, and the like, or from supply-pipes against walls or below the flooring of rooms in which work is carried on. Such leakage may be due to faulty workmanship, to deterioration of fittings by the action of corrosive substances in the gas itself, or to fracture of fittings owing to pressure, &c. Gas companies are apt to alter the pressure considerably during the 24 hours between sunset and sunset, and intermittently altered pressure, of course, subjects fittings to considerable strain. In this connection, it would appear that it is of importance to have some means of estimating quantitatively the amount of coal or carburetted water gas detectable in the air of factories and workshops by the sense of smell, with a view to facilitating the estimation of the amount of carbon monoxide *per se* present, and its relation to the minimum (0·004 to 0·046 per cent.) capable of inducing symptoms in susceptible individuals. Miss Power says flueless gas-stoves seem to deserve especial consideration, inasmuch as they may conceivably contribute carbon monoxide to the air of workrooms from the incomplete combustion of gaseous fuel when in use, and owing to leakage of unburnt gas from defective fittings when not in use. Miss Anderson points out that an important factor to be borne in mind in this connection is the frequent insensibility to the presence of the poison on the part of the human beings exposed to it. She cites an instance in which she entered a workroom where she became immediately aware of a serious escape of gas, which neither the workers nor the forewomen appeared to notice. Application of a match to the fittings of the iron-heater instantly produced a flame. She adds that the close connection between the ventilation, lighting, and heating of workrooms was again and again pressed on her notice last year, and not least in the case of a small workshop, where the occupier was engaged in quiet, steady, and ingenious efforts to evade both the Public Health Act requirements as to ventilation and those of the Factory Act as to the temperature of his workrooms.

On the subject of warming, one of the lady inspectors reports that the means employed in factories she visited in provincial towns during the past year were generally far better than those existing in similar works in London. An installation of hot pipes is the rule rather than the exception; and she found scarcely any unwarmed rooms or rooms warmed by unventilated gas-jets or gas-stoves, as is still too often the case in London. As regards artificial means of lighting, another lady inspector says the continuous use, especially on foggy or dark days, of electric light, has had, she feels sure, very injurious effects on the eyes of the workers, especially where there is a tendency to weakness. She considers that this means of lighting is most beneficial as compared with gas in securing greater purity of air; but over and over again she has noticed the strained look in the eyes of workers who have to use it for many hours at a time, or in rooms where the lights are not sufficiently screened. Occupiers have, however, given every help on this point, and have, in most cases, taken immediate steps to have the lights sufficiently low and screened with green or some other "cool" colour. The number of workers obliged to wear glasses may also depend on the fact that electric light is in constant use in schools; a large proportion of the workers questioned having stated that they suffered from weak sight before leaving school.

The Medical Inspector (Dr. T. M. Legge), referring to poisoning by carbon monoxide, summarizes the reports made by certifying surgeons during the past year. He says 55 persons are referred to as having suffered, with fatal issue in four. There were 20 cases resulting from the inhalation of producer, Mond, or suction gas, 16 from coal gas (in several instances containing carburetted water gas), 17 from blast-furnace gas, and one each from charcoal fumes from a brazier and from the cleaning out of an oil-gas holder. The causes in the cases due to power gas were: (1) Improper situation of the gas plant in the cellar or basement, allowing gas to collect or pass upward; (2) defective fittings; (3) starting the suction-gas plant by the fan, with the chimney-valve closed; (4) cleaning out scrubbers or repairing valves, &c.; (5) defective gasholder. In the 16 cases due to coal gas, the causes were: (1) Gas-jets left on in a weaving-shed all night, the gas containing carburetted water gas, and four workers being affected; (2) defective gas-fittings; (3) escape from underground flues; (4) confined situation of gas-engine; (5) incomplete combustion from a coal-gas fire used for heating water in a small shed of only 200 cubic feet capacity. In the 17 cases due to blast-furnace gas, six were owing to the conveyance of the gas by the wind from a flue left open for cleaning purposes into an engineering shed, two to charging the cupola furnace, two to entering the furnace, and four to cleaning the flues. In addition to the foregoing, mention is made of other slight cases of poisoning; but they did not result in any incapacity for work. Mr. Law (Halifax) and Dr. Legge obtained an order prohibiting the use of an old Dowson gas plant because of the leaky condition of the gas-holder and the occurrence of poisoning, not only to the attendant, but also to women employed in a factory some distance away, but into which the gas had made its way owing to the situation of the plant at the foot of a cliff. It is stated that the iron plates on the top of the holder were worn so thin that with a slight pressure (1½ inches) of

the gas inside they were moving up and down like thin ice when a skater passes over it. There was evidence on these plates of much recent patching of clay—one patch being about 2½ in. by 1½ in. Despite this, the gas had forced its way through, and was coming out in a stream so strong as to cool the hand when placed over it. Escapes of gas could be seen issuing from at least six other defective points. The staging where the coke-furnace of the plant was fed was immediately above this gasholder. Consequently, the fumes would tend to rise and affect the person employed at this point. Dr. Legge points out that the memorandum as to the use of water gas and other gases in factories was further revised during the year. This was given in its amended form in the "JOURNAL" for June 5, 1906 (p. 656).

The report of the Electrical Inspector (Mr. G. Scott Ram) contains tabulated statements in regard to the accidents reported during the past year, accompanied by full particulars in regard to their nature. The table of accidents at the stations of electricity supply companies or local authorities contains the following figures: Caused by non-electrical plant, 200 non-fatal, 8 fatal; electrical plant, 37 non-fatal, 2 fatal. At private electrical generating stations, the non-electrical accidents were 42, of which one was fatal; the electrical accidents being 14, all non-fatal. There were 191 accidents reported in connection with electrical appliances in factories, engineering works, &c.; and eight of them were fatal.

SOUTH METROPOLITAN GAS COMPANY.

Eighteenth Annual Bonus Distribution.

In this month's issue of the Company's "Co-Partnership Journal," Sir George Livesey writes: Eighteen successful years of the Co-Partnership Scheme of the South Metropolitan Gas Company have passed, and the eighteenth bonus is now declared at the rate of 9¾ per cent. on salaries and wages, amounting to about £45,000.

Co-partnership has experienced prosperity and adversity in the eighteen years. The first bonus was at the rate of 5 per cent. in 1890. Then coal became dearer; and the price of gas went up in 1892, and the bonus went down to 3 per cent. It then gradually rose to 9 per cent. in 1900, and, coal again rising in price, gas had to follow, and in 1901 the bonus fell to 3¾ per cent., to rise again gradually to 9¾ per cent. in 1905. We were often told that "so long as the bonus is rising, the workmen will be content; but wait until it falls, and see what will happen." The reply always has been that workmen were quite as reasonable as other people, if matters were explained to them, and with a reduced bonus they would still be content. And so it has happened twice, and will happen again next year. The great advance in the cost of coal makes an increase in the price of gas absolutely necessary. The increase will be to 2s. 3d. per 1000 cubic feet. A reduction of dividend will follow, and also a reduction of bonus, which next year will be reduced to 7½ per cent. Ours is a partnership—a co-partnership, in fact a triple partnership of customers, workers, and shareholders. If it is a true partnership, adversity will not harm it, for adversity brings out noble qualities whose existence cannot be manifested under continuous prosperity. All we have to ask ourselves is whether ours is a true partnership based on right principles. If so, and seeing that all true partnerships are for better, for worse, we must take the rough with the smooth as men. If a real partnership or brotherhood spirit entered into the common affairs of life, the ordinary relations of man with his fellows, whether of business or what not, methinks there would be a strange and much-to-be-desired difference in the world in which we live. I think we are progressing in that direction. There are many and constant indications of a brotherly spirit among us which somehow seems to have grown out of our co-partnership. At any rate, it has developed a comradeship among the employees of all ranks that is very pleasant to see.

I must again remind co-partners that to withdraw and spend the bonus defeats the object we have in view—namely, to help workmen to become owners of property. If this is not done, if, in fact, our system does not improve the condition of co-partners in the present and brighten their prospects for the future, it is useless, and the labour spent upon it is in vain. If, on the other hand, it is the method whereby Capital and Labour can be thoroughly united—the labourer becoming a capitalist, and a partner sharing profit and loss and responsibility—it is worth any amount of effort to make co-partnership an increasing and continuous success. The Directors have done their part. The lasting success of the system depends on the co-partners generally.

I said in 1889, and have often repeated the statement, that we have two objects in view—namely, to give the employees an interest beyond their salaries and wages in working for the Company, and, of quite equal importance, to help them to permanently improve their position in life. Experience now leads me to put the last-named object first, as being sufficient. A body of shareholding employees, thoughtful, thrifty, with a sense of responsibility, animated with a desire to do to others as they would others should do to them, such as co-partnership develops, will do their duty to the Company and take a real interest in the business by which they live.

It is with extreme regret that the Directors have raised the price of gas. Consumers, shareholders, and employees are, however, partners in misfortune which they could not avoid, and all may be assured that the price will be reduced as soon as possible.

Gas and Electricity Supply in Denver (Col.).—The people of Denver (Col.) evidently have confidence in the stability of the local Gas and Electricity Company, for of the $220,000 in dividends of which the distribution was commenced on the 2nd inst., more than $100,000 will be placed to the credit of residents in Denver. It appears that the greater portion of the stock was formerly held by Columbus people; but with the improvement in the Company's position which has coincided with business activity in the city, it has gradually changed hands. It now stands at 82, with a 6 per cent. dividend; and it is expected soon to reach par.

ACCRINGTON GAS AND WATER BOARD.

The Export Coal-Tax.

In the course of his report for the year to March 31 last, Mr. C. Harrison, the General Manager of the Accrington District Gas and Water Board, makes the following remarks.

From October, 1905, the price of gas was reduced 2d. per 1000 cubic feet to all users. This, therefore, is the first full year's experience at the present rates. The coal carbonized during the year was 40,342 tons—an increase of 2672 tons. The make of gas was 429,347,000 cubic feet, showing an increase of 20,443,000 feet. The make per ton was 10,642 cubic feet, or 213 cubic feet less than last year, which is accounted for by the Board being compelled to purchase coal wherever it could be procured; the large foreign demand having interfered, not only with the gas industry, but the country generally. The removal of the 1s. tax is to a large extent the cause of the increased shipments to foreign parts, and of great injury to the gas industry. The advance of 2s 6d. per ton means an additional charge on the gas-works of this country of about £1,875,000 for the current year, and to your Board alone of some £6000.

There have been added 384 new consumers during the year, 25 additional street-lamps, and 610 cookers and gas-fires. There are now 5744 cookers and fires in the Board's district. The number of prepayment meters is 5355, and the average consumption per meter is 10,238 cubic feet—an increased average of 670 cubic feet per meter. The gross profits for the year are £21,822; and after payment of the annuities, interest on debenture stock and mortgage bonds, contributions to sinking fund, income-tax, and capital charges paid out of revenue, there remains a balance of £3319 to meet the deficiency on the water undertaking of £2953.

The revenue from water amounts to £22,741, an increase of £611 for the year. The deficiency in this department amounts to £2953, being £520 less than last year. The water filtered and pumped into the district from the Dean reservoir amounted to 305,625,000 gallons, and the quantity filtered but not pumped to 2,330,000 gallons; making a total of 307,995,000 gallons taken from the Dean reservoir during the year. There have been added 228 new consumers during the year. The total length of water-mains is 71 miles.

GAS AND WATER AT MANSFIELD.

The gross profit on the past year's working of the Mansfield gas undertaking is £7727. After allowing for interest on loans (including Treasurer's interest) £3492, and contributions to sinking fund £1234, a net profit remains of £3001. The receipts from the sale of gas were £100 less than in the previous year. This is accounted for by the reduction in the price. Residuals realized about £250 more. The expenditure on the manufacture of gas was £1100 less than in the previous year, owing to the fact that there was in the former year exceptional expenditure in the retort-house. The price of gas was reduced to 2s. 4d., 2s. 6d., and 2s. 8d. per 1000 cubic feet, according to consumption, from Dec. 31 last. It has also been decided that from March 31 the price of gas for engines only should be reduced to 1s. 6d., 1s. 9d., 2s., and 2s. 2d. per 1000 cubic feet, according to consumption. The Committee have decided that the sum of £2000 shall be paid over to the general district rate, and that the balance of profit (£1001) shall be appropriated to the reserve fund.

The report dealing with the water undertaking shows that the total income for the year (four quarters) amounted to £9517, compared with £10,559 for the previous year (five quarters). The total expenditure, apart from dividends, interest, and sinking fund (twelve months) was £2325, as against £2498 in the previous year (thirteen months). The gross profit amounts to £7212. After payment of interest on loans £2114, and contributions to sinking fund £1589, a net profit of £3509 has been made. The Committee have decided to pay over the sum of £3000 to the general district rate, and to appropriate the balance of £507 to the reserve fund.

GAS AND WATER ADMINISTRATION AT BARRY.

Further Consideration of Mr. Porter's Report.

The Barry Gas and Water Committee have lately been considering the report by Mr. Robert Porter, of Elland, who had been asked to inquire into the management and general administration of the gas and water undertakings. Portions of the report on the gas-works were given in the "JOURNAL" for the 9th inst. (p. 117); and it was stated that, after this had been discussed, the matter was adjourned for a fortnight, so as to enable Mr. F. M. Harris, the Engineer and Manager, to prepare a statement. The Committee met again yesterday week, when Mr. Harris's statement and Mr. Porter's report on the water-works were considered.

Mr. Harris commenced by remarking that he assumed there was no need to make comments or statements of fact, among which were included the site of the works, the unaccounted-for gas, and the capital employed, which was largely influenced by, if not mainly due to, the amount paid for the undertaking. He then proceeded to consider points that Mr. Porter had criticized. He said that at the time Mr. Porter paid his visit, they were on the point of painting certain portions of the plant—the condensers, washers, scrubbers, &c.—not, however, at the suggestion of Mr. Porter, but in the ordinary course of work. Situated as the gas-works were so close to the coal-tips of the docks, the dust arising and intermingling with that made in the ordinary course of gas manufacture, soon altered the appearance of paint work, and neutralized any good effect. At the previous meeting, comment was made upon the fact that he (Mr. Harris) had complained that the works were undermanned, and

that, at the request of the Committee, he had had to dispense with the labour required. The question of the number of men employed had been raised during the consideration of each estimate; and this statement was confirmed in a minute of the Council, which stated that the Committee considered one jointer in a gang sufficient, and accordingly the last jointer engaged must be dispensed with, but be offered a job as labourer, and, if the position was accepted, that a labourer be discharged. A further minute recommended that the Gas Engineer should dispense with the services of the last gas-fitter engaged, and also with the services of any boys who accompanied fitters who were not required. With the exception of one bed, the horizontal retorts were practically burnt out, and required renewing. With a good deal of patching and repairing, some work could no doubt be obtained from the five through beds of horizontal retorts; but Mr. Harris did not believe Mr. Porter intended to convey the impression that the horizontal retorts would yield 480,000 cubic feet in the 24 hours under existing conditions. Mr. Harris regretted that on the working of the inclined system, he could not make his figures agree with those of Mr. Porter. In making the statement that a sufficient sum had not been spent each year to maintain the undertaking in an efficient manner, Mr. Porter was doubtless unaware that nothing had been expended for the repair and renewal of retorts for the past three or four years, which sum (about £500 a year) would go a long way towards bringing the amount up to that suggested by Mr. Porter. The statement that the method of driving elevators and conveyors from gas-engines was far more expensive than steam, was an open question. The engines were worked intermittently; and the Council received a good price for breeze. Mr. Harris agreed that additions to the exhausters would soon be necessary, and the station-meter ought to be replaced with a new one of larger capacity, as the maximum capacity had often been exceeded, and the risk of failure, more especially with exhausters, was serious to contemplate. At the time Mr. Porter called, one workshop only was in use for the Gas Department; and this was employed principally for cleaning cooking-stoves. No exception was taken to any of the plant when inspected by the expert engineer consulted by the Local Board when the works were acquired in 1894; and the fact that the plant was now producing quite four times the quantity it was in that year, was a good test of its efficiency. Mr. Porter made no recommendation on the question of coal, or as to any particular class of coal to give the best results; and to Mr. Harris's knowledge he had not had any experience of local coal. To make no reference at all to the matter, was the only course Mr. Porter could adopt.

Mr. Porter's report on the water-works was then taken. In it, he said that in 1895 the capital employed was £132,551; the amount of water provided, 151,710,000 gallons; and the net rentals amounted to about £5000. At the end of 1905, the capital employed was £176,143; the quantity of water provided, 253,804,000 gallons; and the net rentals amounted to £8228. The increase in the daily consumption during the ten years was 361,927 gallons. The total water-mains laid represented 65 miles; and the population supplied with water, 32,000. There had been a decided reduction of capital per million gallons employed; but, owing to the wide area supplied, and the sparsity of the population, this must remain a burden on the undertaking for many years. The total cost of pumping, wages and salaries, maintenance, rates and incidentals, amounted to £4443. Much depended upon the efficiency of the pumping-station at Biglis, because it was the source from which the water was obtained; and 50 per cent. of the expenditure was incurred there. Generally, Mr. Porter was of opinion that whatever good work may have been accomplished during the past by the plant, the whole of it was now absolutely obsolete, and incapable of performing the functions required with anything approaching efficiency. Owing to their small capacity, the existing boilers had been the cause of extravagance for some years. The storage of the high and low level supplies increased the gravity of the situation regarding the pumping-station. The low-level reservoir was much below the amount required for efficiency and economy; and as this supplied five-sixths of the population, and had much less than two days' supply, it was needless to enlarge on the importance of prompt action by the Committee and management, so as to prevent a calamity which might seriously menace the well-being of the district. Mutual confidence ought to be exercised by the Committee and Engineer, and he was of opinion that the administration of the undertaking would with advantage be better accomplished by a Committee acting altogether separate from the Gas Committee. Having regard to the future requirements of the Gas and Water Department, and the various and complex questions which must arise during the reconstruction and development of the concerns, there would be sufficient employment for a separate Engineer and Committee for each of the undertakings.

Mr. E. W. Waite, the Water Engineer, had prepared a reply to this, in which he agreed that, owing to the wide area and sparsity of the population, the capital must remain a burden upon the undertaking for many years. Regarding the ratio of population to mileage of mains, Barry was undoubtedly considerably lower than the great majority of towns. He had called the attention of the Committee to the serious necessity of adding to the pumping plant and boiler power; the former consisting of one pair of vertical triple expansion pumps, and two horizontal pumps. The vertical pumps were undoubtedly becoming obsolete, but were useful as a stand-by. However, the two horizontals, upon which they had to depend, were in excellent condition. Inasmuch as machinery of the highest workmanship was liable to accident, he strongly advised the acquirement of a new pump capable of lifting 50,000 to 60,000 gallons per hour. The boilers were in good condition; but he urged the use of coal to a larger extent. As a result of the many hundreds of empty houses becoming occupied, the need of extra storage accommodation was again becoming apparent. A covered reservoir, with a capacity of 3 million gallons, should be constructed as early as possible. This, with the existing accommodation, would ensure a supply for seven days. An excellent site for a reservoir was to be found in a field to the west of the existing reservoir, with the additional advantage of an elevation which would provide an adequate pressure of water in certain portions of the district on the low-level system. A considerable amount of water was wasted on account of defective fittings and carelessness; and this could only be obviated by regular inspection, especially at night. With over 60 miles of mains, and a steadily increasing population, he did not think the present inspection staff of three men adequate. An additional inspector, chiefly for night work, would be of great service. Speaking generally, he did not agree with Mr. Porter that the whole of the pumping plant was obsolete; the larger portion being capable of doing good work for some time to come. With his remarks as to the necessity of keeping the plant well in advance of immediate requirements in so important a matter as water supply, Mr. Waite entirely agreed; and he hoped the Committee would, in the general interests, and for the adequate protection of the town, agree to the proposals he had made.

The meeting was, after some discussion, adjourned until Thursday, when Mr. Davies moved that the Council be recommended to place the two departments under one Manager. This was carried by five votes to two; and upon this further resolutions were carried in a like manner, to determine the services of the Gas and Water Engineers respectively. It was agreed to recommend the Council to advertise for a Manager for the Gas and Water Departments combined, at a salary of £400 a year. All these resolutions will come forward for discussion in the form of recommendations to be dealt with by the Council at a special meeting to be held to-day. During the proceedings, some reference was made to coal tests; it being remarked that the Committee had not been supplied with comparative tests for certain classes of coal. It was thereupon suggested by Mr. Williams that all resolutions should be made known to Mr. Harris; and he asked whether that official had declined to provide the information desired by the Committee, and whether, if he had not given it, it was due to causes of over-work. After discussion, the resolution moved by Mr. Davies was communicated to Mr. Harris, who stated that the men were at present working at their full capacity; and it would be dangerous for them to attend to coal tests as well as provide gas for the town.

SULPHATE OF AMMONIA COMMITTEE.

Extracts from Annual Report—Effect of Sulphate of Ammonia on the Yield of Crops.

At the recent meeting of the subscribers to the Sulphate of Ammonia Committee, the Executive Committee submitted their tenth annual report, together with a statement of accounts for the year ending June 30. The following are extracts from the report, which was submitted and adopted.

The number of competitions organized for the Committee's prizes during the period under notice was 72; but, as in previous years, several were abandoned for lack of sufficient entries and other causes, and only 66 were actually concluded. The considerable diminution in the total number of competitions, compared with previous years, is due to the fact that the Committee have again confined their offer of prizes to the more important Societies, and have endeavoured to prevent the overlapping of districts which occurred in former years. During the current year, special efforts have been directed to getting Agricultural Societies, which have not hitherto taken up the Committee's offer of prizes, to do so this year; and out of 78 competitions arranged, 25 were undertaken by Societies which have not hitherto competed. Last season's competitions are briefly dealt with in the preliminary report of the Committee's Technical Adviser; and the results are regarded as satisfactory in spite of the generally unfavourable season for potato and root crops.

As in previous years, the Committee's advertisements appeared in the chief agricultural and horticultural papers and periodicals during the continuance of the manuring season.

The Committee's representative, who was appointed last year, has, during the past twelve months, visited the chief agricultural centres in England, where he has interviewed the Secretaries of Agricultural Societies and called on agricultural and horticultural dealers and manure merchants with a view to securing their co-operation in increasing the sales of sulphate of ammonia. To aid them in this, the dealers have been supplied with large quantities of the Committee's literature, with their names and addresses printed on the covers, for circulation among their customers.

The Committee's show-stand was exhibited at the following Agricultural Shows, where samples of sulphate of ammonia and specimens of agricultural produce grown with its aid were shown; and your representative distributed large quantities of literature and supplied general information: The Peterborough Agricultural Society's Show at Peterborough, July 10 to 12, 1906; the Northumberland Agricultural Society's Show at Newcastle-on-Tyne, July 25 to 27, 1906; the Royal Lancashire Agricultural Society's Show at Lancaster, Aug. 2 to 6, 1906; the Devon County Agricultural Society's Show at Bideford, May 22 and 23, 1907; the Essex County Agricultural Society's Show at Chelmsford, June 12 and 13, 1907; the Herefordshire and Worcestershire Agricultural Society's Show at Hereford, June 18 to 20, 1907; the Royal Agricultural Society's Show at Lincoln, June 25 to 29, 1907; the Highland Agricultural Society's Show at Edinburgh, July 9 to 12, 1907. The Committee will also exhibit at the Yorkshire Agricultural Society's Show at Barnsley, Aug. 8 to 12 of the present year.

The Committee are exhibiting at the Irish International Exhibition in Dublin, where, in addition to their stand, they have a number of very interesting experimental plots, which are attracting considerable attention. On these plots are being grown various kinds of potatoes, mangels, swedes, turnips, grain, grasses, &c., manured with sulphate of ammonia in combination with potash salts and superphosphate; and on adjoining plots, for the purpose of comparison, are similar crops manured as above, but with sulphate of ammonia omitted from the mixture.

During the year, the Committee have (as an advertisement) disposed of about 55 gross of their decorated tin canisters to subscribers and dealers, and the window lettering has been placed on the premises of upwards of 200 agricultural and horticultural dealers, &c., in different parts of the United Kingdom.

The new subscribers secured during the year number 28, with an

estimated annual production of 7000 to 8000 tons of sulphate of ammonia. The subscriptions for the year show a total increase compared with the preceding year of equal to about 16,000 tons.

From the report of the Committee's Technical Adviser, the following tables are taken, showing the large additional yields in crops per acre obtained in the competitions by the application of sulphate of ammonia.

Class I.—Yellow Turnips.

11 Competitions, embracing a total of 128 entries—all Scottish.
1—Morayshire Farmers' Club.

	Crop per Acre. Tons.	Cwt.	Qrs.	Lbs.
With sulphate of ammonia. . . .	56	11	1	20
Without ,, ,, ...	42	0	0	0
Increase	14	11	1	20

Class II.—Swedes.

23 English Competitions, embracing 173 entries.
1—Cartmel Agricultural Society.

	Tons.	Cwt.	Qrs.	Lbs.
With sulphate of ammonia. . . .	44	10	0	3
Without ,, ,, ...	31	0	0	0
Increase	13	10	0	3

11 Scottish Competitions, embracing 140 entries.
1.—Morayshire Farmers' Club.

	Tons.	Cwt.	Qrs.	Lbs.
With sulphate of ammonia. . . .	48	5	1	24
Without ,, ,, ...	40	1	1	20
Increase	8	4	0	4

Class III.—Mangels.

18 Competitions, embracing 112 entries (all English).
1.—Mid-Somerset Agricultural Society.

	Tons.	Cwt.	Qrs.	Lbs.
With sulphate of ammonia. . . .	78	11	1	20
Without ,, ,, ...	65	0	0	0
Increase	13	11	1	20

Class IV.—Early Potatoes.

No competitions.

Class V.—Late Potatoes.

3 Competitions, embracing 18 entries (all English).
1.—Middlesex Agricultural and Market Garden Society.

	Tons.	Cwt.	Qrs.	Lbs.
All grown with sulphate of ammonia.	14	6	0	0

METROPOLITAN WATER BOARD.

The Board's Capital Expenditure—The Value of Storage.

At the Meeting of the Board on Friday—Sir Melvill Beachcroft in the chair—the Finance Committee reported that, according to a statement received by them from the Comptroller (Mr. F. E. Harris), the total expenditure on capital account from the "appointed days" on which the Board took over the water undertakings to March 31 last amounted to £2,684,387, of which £2,143,844 had been raised by the issue of stock—leaving a deficiency of £540,543 on the aggregate account. The deficiency had been met to the extent of £491,733 by the issue of £500,000 Metropolitan Water Board bills; and the difference was provided out of the Board's current balances. It was decided to apply to the Local Government Board for consent to the raising of a number of loans, including one of £68,330 in respect of the general extension of service mains, and £54,539 in respect of special mains.

On the recommendation of the Finance Committee, it was agreed that the Board should not take out a policy of insurance against risks under the Workmen's Compensation Act, 1906, for the ensuing year, but that they should set aside for such year a sum equal to a rate of 9s. per cent. upon the salaries and wages paid within this period to officers and workmen coming within the scope of the Act, and that a full record be kept of cases arising under the Act during the year.

On the subject of the Board's Charges Bill, Mr. Emden complained that further opportunity had not been afforded for the discussion of the proposals contained in the Bill; and he moved the adjournment of the Board in order to call attention to the matter. He said it had been reported that a considerable amount of relief was to be given to large traders, by reducing the rates to them to something like cost price; while the smaller traders were to be charged the full price, and the balance of the expense was to be thrown on those who were already excessively rated, and on the general class, by whom the bulk of the rates were paid. Mr. J. M. Stone (the Vice-Chairman of the Law and Parliamentary Committee) said the Committee had been pressed by the Local Government Board to amend the trade scale as printed in the Bill. They had not seen their way to do this; but, in view of the strong feeling shown in regard to the matter, it was thought likely that an amendment might be supported by the Local Government Board. The Committee had had an opportunity of conferring with the President; and it was thought that if any amendment should be insisted upon its effect would be to reduce by something like £24,000 a year the increased yearly revenue of £52,000 which the Bill proposed to obtain from trade consumers. The motion was lost by a large majority.

The Water Examination Committee presented an exhaustive report, which had been prepared by the Director of Water Examinations (Dr. A. C. Houston) respecting the work carried out at the Board's laboratory during the twelve months ended March 31 last. The report gave in considerable detail the results obtained in the testing of 11,993 samples of London waters, and also dealt at length with the important question of the value of storage. He pointed out that there is a consensus of opinion among bacteriologists that pathogenic microbes do not multiply in storage reservoirs, but gradually lose their vitality. The time required to effect the destruction of these bacteria is matter for controversy; and though the American authorities consider a few days may suffice, most British bacteriologists place the limit at a much longer period. The essential point is that each day's storage makes for safety, and that a time eventually arrives when all the pathogenic bacteria have perished; and in such a case subsequent filtration alone is required to improve the chemical and physical qualities of a water already incapable of giving rise to epidemic disease. From the epidemiological point of view, apart from any question of cost of pumping, the storage reservoirs should be so worked as to give each drop of river water abstracted for water-works purposes the maximum number of days' detention in store. Dr. Houston concluded by submitting the following points as being of importance: The unsatisfactory quality of the raw waters, particularly during the winter months, and the necessity for the judicious selection of such waters for purposes of supply; the doubt existing as to whether these waters, even during the best months of the year, are sufficiently free from impurities to be filtered without antecedent storage; and the importance of possessing as full knowledge as possible of the multiple polutions of the Thames and Lea. On the subject of storage, Dr. Houston directed attention to the unequal, and in some cases inadequate, duration of storage in connection with the Board's works, as well as to the difference between "active" and "passive" storage; and he emphasized the importance of the former. The rate of filtration at the different works of the Board is unequal, and in some cases inadequate, owing to the small size of the service reservoirs. On the subject of filtered water, Dr. Houston mentioned the following points: The variable, and in some cases not altogether satisfactory, quality of the water as delivered to the consumers, and its general deterioration during the winter months; the remarkable percentage improvement in the raw water effected by the process of storage and filtration; the satisfactory quality, generally speaking, of the water supplied to the Metropolis, as judged by average results, more particularly by those obtained during the summer months; and the importance of bringing the worst results more closely into agreement with the best, by endeavouring to reduce the manifold pollutions of the Thames and Lea, by the judicious selection of raw water, by the active utilization of storage reservoirs, and by slow filtration at a uniform rate through sand of sufficient fineness and depth.

An estimate of £30,000 in respect of pumping machinery, houses, &c., at Walton was approved on the recommendation of the Works and Stores Committee. It was also decided, after some discussion as to designs, to erect a water-tower on the Board's land at Shooter's Hill, the estimate for the construction being £5000.

Bahia Blanca Gas Company, Limited.

In another part of the "JOURNAL" will be found the prospectus of this Company, which has been incorporated with a capital of £300,000, in 46,000 ordinary "A" shares of £5 and 70,000 ordinary "B" shares of £1. The prospectus sets forth that the Bahia Blanca Gas-Works (Construction) Syndicate, Limited, which was formed on June 26, 1906, entered into a contract for the acquisition of a permit from the Municipality of Bahia Blanca, in the Argentine Republic, to instal in the precincts of the city a manufactory of illuminating gas, with the capacity to produce as a minimum 3000 cubic metres in 24 hours, and for the acquisition of a suitable plot of land, about 16½ acres in area, situate in the vicinity of Bahia Blanca; and that they have erected thereon gas-works, machinery, and plant approaching completion, with a capacity to produce 60 million cubic feet of gas per annum. The undertaking is reported to be practically in order for the supply of gas within about a month from the present time. The Syndicate are the promoters of the Company, who, according to the prospectus, will acquire "the permit, the land, and all the works as constructed, and other benefits and rights," for £70,000 in fully paid-up ordinary "B" shares and £70,000 in cash or ordinary "A" shares, fully paid-up, at the option of the Company, and £44,530 in cash, the last two amounts being the estimated expenditure of the Syndicate upon a cash basis. The present issue consists of 30,000 ordinary "A" shares at par, leaving 16,000 for future issue. Out of the profits available for distribution in each year, the "A" shares will be first entitled to a non-cumulative dividend of 6 per cent. per annum; then the "B" shares will be entitled to a like dividend; and the surplus profits will be distributed as to one-half among the "A" and the other half among the "B" shares. The three Directors are members of the Board of the Buenos Ayres (New) Gas Company, Limited, and applications from shareholders in that Company will receive prior consideration.

New Joint-Stock Companies.—The Sunlight and Safety Lamp Company, Limited, with a capital of £50,000, in £1 shares, is to acquire from the Sunlight and Safety Lamp Company, Limited, and its Liquidator, the business of the old Company, and to carry on the business of manufacturers and exporters of, and dealers in, oil, gas, electric, and other lamps, lamp accessories, and heating and lighting appliances of all kinds. "Monazite" is the title of a Company registered with a capital of £7500, in £1 shares, to carry on the business of company promoters, financiers, &c. The Aristodas Dustless Roads Syndicate, Limited, with a capital of £2000, in £1 shares, will adopt an agreement with J. W. Metcalf to acquire the patents granted to him for an invention for a new method of tarring roads and apparatus and machinery therefor, together with any subsequent inventions therein. The Anchor Tube Company, Limited, with a capital of £50,000, in £1 shares (10,000 shares being 5 per cent. preference), is to acquire, as from April 1, 1907, the business of tube manufacturers carried on in Gas Street, Birmingham, and elsewhere, as the Anchor Tube Company; to adopt an agreement with T. Turley, J. H. Turley, and C. H. Turley; and to carry on the business of manufacturers of, and dealers in, iron, steel, brass, copper, and other tubes, pipes, fittings, and boilers, metallurgists, engineers, &c.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners have not benefited by delaying to enter upon contracts for coal for the current year. In the end of April they purchased 40,000 tons of cannel, and delayed consideration of the purchase of common coal. At that time, it was reported that the increase in the price of the coal tendered was 3s. 4d. per ton. On Monday last they held a special meeting, at which they purchased 94,000 tons, to supply them till May of next year. There must be a large stock of coal on hand, because the two purchases amount together to 134,000 tons, whereas the quantity of coal carbonized during the past financial year was 178,524 tons. The prices on this occasion were not disclosed; but it is understood that the increase, all over, is about 4s. per ton, as compared with what was paid last year. The increase in price will amount to about £20,000 in the year. A penny per 1000 cubic feet of gas produces £7952; consequently it will be seen that the increase in the cost of coal will not amount to quite 3d. per 1000 feet of gas. The price, I understand, is not likely to be raised by so much as that, but that will not be known at the earliest till September, when the price for the year comes to be fixed.

The "Glasgow Herald"—attentive, as usual, to the interests of the Commissioners, where coal is concerned—on Tuesday published the following comment upon the transaction: "It was mentioned in the 'Herald' in April last that the increase in the price of coal had caused the Edinburgh and Leith Gas Commissioners to postpone placing their coal contracts for the year, in the hope that a more favourable opportunity might present itself for purchase. At that time the total quantity offered was not more than about one-half of what was usually offered in response to the Commissioners' invitation for tenders. There were then various causes at work; but, so far as could be ascertained then, the increase in exports could not account for such an apparent shortage. The prices seemed to have moved upwards in proportion to the diminishing available supplies. Yesterday the Works Committee of the Commissioners considered the report of Mr. W. R. Herring, the Engineer, on the tenders for coal, and considerable discussion ensued in private. It was afterwards intimated by the Chairman—Judge Bryson, Leith—that the Committee had agreed to purchase 94,000 tons of coal to May next. While the price was not disclosed, it is understood that the average price is 13s. 9d. per ton, representing a difference of some 4s. per ton more than the price paid last year, or, taken in the gross, £18,800. This means that the gas-consuming public will be required to pay the difference." This statement is remarkably like what was in circulation at the close of the meeting, and points to the view that the comments which the "Glasgow Herald" consistently publishes whenever the Commissioners are engaged upon considerations relating to the coal market are inspired.

The Commissioners have been unfortunate in again getting into Court over the pollution, this time, of the second well, in Messrs. Muir's brewery. The action is a more drastic one than was the last, inasmuch as the sum sued for as damages is £15,000, as against £10,000. Both sides have profited by the experience of the last case; the pursuers having framed their record more skilfully, and the defenders being able to put forward the powerful plea that the remedial measures they are taking, and the sum they have already paid, must be taken into account. In face of this plea, the case cannot be disposed of with anything like haste, as time must be allowed for the ascertainment of the effect which the operations of the Commissioners may have. As a matter of fact, nothing can be done in the case until October, the Court being now in vacation till then. At their meeting on Monday, the Commissioners instructed the Clerk to pay the expenses incurred in the first action—the expenses of the Messrs. Muir, of course—and resolved in the second action to take the award of the Court.

I have received from Mr. R. S. Carlow, the Secretary of the North British Association of Gas Managers, the notice calling the meeting of the Association—the forty-sixth—to be held in Glasgow on Thursday next. Three papers are to be submitted, which is the same as last year. But there is a good deal of other business, some of which will doubtless be taken up, and will occupy some time in discussing. There is the proposal to alter the name of the Association to "The Scottish Institution of Gas Engineers," which may be expected to drag in the question of affiliation. Then there are the proposal to form a Commercial Section, for the assistance of the members in the disposal of bye-products, and the suggested M'Gilchrist Memorial. These three subjects were left over from last year's meeting. There are, in addition, two other matters of longer standing—the question of the publication of the late Mr. Wm. Young's communications to the Association, and the holding of a naphthalene inquiry. It will be apparent to everyone, therefore, that a full day's work is before the meeting, which probably accounts for the early start that is to be made—ten a.m.

At the annual meeting of the Selkirk Gaslight Company on Wednesday, the Directors reported that the quantity of gas manufactured during the year was 37,012,000 cubic feet—an increase upon the previous year of 1,162,000 cubic feet. The quantity of coal carbonized was 3618 tons 11 cwt.; the yield of gas being 10,228 cubic feet per ton. It was also reported that the works were in excellent order, and no expense, beyond the ordinary renewal of retorts, was anticipated upon them during the current year. The Directors recommended that the price of gas be reduced by 2½d.—making it 2s. 6d. per 1000 cubic feet. It was also stated that they had received from the Town Council an offer of £10,087 10s. for the undertaking of the Company, but the offer appeared to the Directors to be so inadequate that they had declined it without deeming it necessary to submit it to the shareholders. The year's profits amounted to £1361, which was recommended to be disposed of as follows: Dividend at 10 per cent. on original capital, £453; depreciation, £250; and surplus account, £658. The expenditure was £4461, and the income £5823. In the balance-sheet, the works, including additions, are entered at £21,224. The report was adopted unanimously.

The annual meeting of the Montrose Gas Company was held on Wednesday. The Manager (Mr. A. Mackay) reported that the quantity of gas manufactured during the year was 31,141,000 cubic feet—an increase of 1,500,000 cubic feet over the previous twelve months. New meters fixed numbered 422. Of these 141 were for fresh consumers. The number of boiling-rings, grills, cookers, and gas-fires fixed was 262. Leakage was reduced by 2 per cent. The profit, after ample allowance for depreciation, amounted to £1038. A dividend was declared at the same rate as last year—£2 per share. Mr. A. Muirden, the Chairman, stated that, notwithstanding the great increase in the cost of coal, the Directors did not anticipate that it would be necessary to raise the price of gas during the current year. The shareholders visited the gas-works, to inspect the retorts recently erected. These comprise twenty mouthpieces. The method of firing is on the shallow regenerative principle. Mr. Mackay prepared the plans, and superintended the work of the Contractors (Messrs. Robert Dempster and Sons, Limited, of Elland). Bailie Thomson paid a high compliment to the Manager for the way he had carried out the work, and moved that it be an instruction to the Directors to substantially increase Mr. Mackay's salary. The Chairman seconded this; and it was unanimously agreed to.

The Brechin Gaslight Company, Limited, held their annual meeting on Wednesday—Mr. J. Guthrie, J.P., in the chair. The Directors recommended the payment of a dividend at the rate of 7 per cent., free of income-tax. The Chairman said that the dividend was for twelve months this time, whereas a year ago it was for thirteen months. They were thus paying a little more on this occasion. The increased consumption of gas amounted to 1¼ million cubic feet. They did not expect so large an increase. Notwithstanding that all the factories in the town produced their own light, that the public lamps were lighted by electricity, and that a large number of shopkeepers used the same light, the Company were in the position that they were making, and the community were using, more gas than they did in the most prosperous days of the old Company (before registration). The income from the ordinary meters was £2803; and from prepayment meters, £2109. If it were not for the latter they would not be where they were. Of course, the prepayment meters meant a great deal of capital outlay; but this was a part of the business which was not being pushed. They had erected a new gasholder, at a cost of £1500, which gave them an increased holding capacity of 60,000 cubic feet. They had allowed £480 for depreciation, which was £23 more than a year ago. As they all knew, the cost of coal had greatly advanced; but it would be pleasant intelligence that there would be no increase in the price of gas. The report of the Directors was adopted; and they were voted £50 as remuneration for their services.

At the annual meeting of the Saltcoats Gas Company, Limited, on Tuesday, the Directors reported that the balance at credit of the profit and loss account, after providing for depreciation of works, amounted to £1579. They recommended the payment of a dividend of 7½ per cent., absorbing £1200, and the carrying forward of £379. The consumption and the revenue from gas are still increasing. It was agreed to continue the price of gas at 3s. 4d. per 1000 cubic feet, and at 2s. 11d. for the public lamps. The premises and plant are in good order. The quantity of coal carbonized was 2578 tons, costing £1545, with £56 for cartage. The gas made amounted to 26,849,500 cubic feet, equal to 10,453 cubic feet per ton. The gas unaccounted for amounted to 5 per cent. The number of ordinary consumers was 2324; and of prepayment meters, 117—the former being an increase of twenty, and the latter of eleven. The number of grillers, &c., on hire is 89. The revenue from gas was £4177; hire of grillers, £4 9s.; meter-rents, £48; tar and liquor, £298; and coke, £340.

Hoylake and West Kirby Gas and Water Company.

The report of the Directors and the accounts for the year ending June 30 (which will be submitted at the thirtieth ordinary general meeting next week) state that the balance at the credit of profit and loss, after payment of the dividends in respect of the year to June, 1906, was £468, to which has to be added the net revenue for the past twelve months, £6838—making a total of £7306. Deducting the interim dividend paid in January (£2320), there is now available a sum of £4986. From this, the Board recommended the payment of the following dividends: 6 per cent. on the "A" gas original capital; 4½ per cent. on the "B" gas additional capital; 6 per cent. on the "A" water original capital; and 4½ per cent. on the "B" water additional capital. These will absorb £3479, and leave a balance of £1507. After transferring £100 to water back-dividend reserve, and £100 to water contingency fund, there will be a sum of £1307 to carry forward. The dividend scheme now announced, together with the interim dividend paid in January, makes a total distribution, less income-tax, for the year of 10 and 7 per cent. on the "A" and "B" capitals respectively. The gas reserve fund now stands at £1565. The Directors regret to state that the price of coal for the ensuing year has considerably advanced. The quantity of gas supplied last year to private consumers and the public lamps was 52,184,054 cubic feet. The price of gas during the period under review was 3s. 6d. per 1000 cubic feet, less varying discounts; while the charge to users of prepayment meters was 4s. 2d.

Opening of a New Pumping-Station at Bedford.—The Mayor of Bedford (Mr. George Haynes), on the invitation of Mr. Joseph Miller, the Chairman of the Water Committee, lately opened a new pumping-station, containing machinery capable of raising a million gallons per 24 hours when running at ordinary speed. The distance from the floor of the house to the top of the rock is 43 ft. 6 in.; while the rock itself has been excavated 17 ft. 6 in.—making the total depth 61 feet. At this depth it was found impossible (with a sinking pump throwing 1¼ million gallons a day) to keep the water down. The total cost of the scheme has been £6248. The Mayor remarked that he never knew a building and machinery to be put up cheaper or better. The work was carried out under the instructions, and to the plans, of the Borough Engineer (Mr. N. Greenshields). The Contractor for the buildings and foundations was Mr. Samuel Foster; while Messrs. Simpson and Co. supplied the machinery, and Mr. John Thompson the boilers.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 20.

Sulphate of Ammonia.

Quietness still prevails, there being no special demand for any point, and prices have barely been maintained, although available supplies are not large. The closing quotations, however, remain £11 15s. per ton f.o.b. Hull, £11 17s. 6d. per ton. f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has been more direct inquiry in the forward position; but the ideas of buyers are not above spot values, while makers require a premium of 2s. 6d. to 5s. per ton, according to position. Consequently, any business done has been taken speculatively.

Nitrate of Soda.

This article is quiet but steady at 11s. to 11s. 3d. per cwt., according to quality.

LONDON, *July* 20.

Tar Products.

There is very little business doing in tar products, and it is unlikely that there will be any great revival of business at present. Pitch remains in about the same position. Business is impossible for prompt delivery, as shipping is now done for the season; while for forward, the ideas of manufacturers are so much over those of dealers (they being unable to obtain any such prices from the Continent) that the latter have no opportunity of buying at present. Continental orders are scarce just now, though doubtless there will be some amount of buying towards the end of the month of August. Creosote is very firm in all directions. Manufacturers do not seem at all anxious to sell any great quantity for forward delivery. It is reported that there are still large orders to come from America, which will have to be placed in this country. Carbolic acid remains in about the same position. Continental consumers refuse to increase their limits; and as manufacturers are well sold, they are not inclined to consider the prices now offered. There is no alteration in crystals. Benzol, 90 per cent., is still quiet, and very low prices are offered for delivery all over next year. Benzol, 50-90's, and toluol are quite without interest, as consumers of these articles are very fully stocked and do not care to increase their liabilities at present. Solvent naphtha appears to be easy in the North, where business is reported to have been done at under 1s., while this price is quoted for delivery all over next year. In London, it is still firm, as actual London makes are in good demand, and manufacturers are pretty well sold. In tar, a contract of some importance is reported to have been let, for delivery over the next three years, at a figure considerably under the minimum price now quoted in this column.

The average values during the week were: Tar, 16s. to 20s. Pitch, London, 26s. nominal; east coast, 25s. to 25s. 6d.; west coast, 23s. 9d. to 24s. 6d. Benzol, 90 per cent., 7½d. to 8½d.; 50-90 per cent., 5¼d. to 9¼d. Toluol, 10¼d. to 11½d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. to 1s. 2¼d.; heavy naphtha, 1s. 1½d. to 1s. 3½d. Creosote, London, 2⅞d. to 3d.; North, 2½d. to 2¾d. Heavy oils, 3d. to 3¼d. Carbolic acid, 60 per cent., 1s. 7½d. to 1s. 7¾d. Naphthalene, £6 to £12; salts, 37s. 6d. to 42s. 6d. Anthracene, "A" quality, 1½d. to 1¾d.

Sulphate of Ammonia.

There is practically no alteration in prices. The principal London Gas Companies still ask £12 2s. 6d. to £12 5s., but no business is reported at this figure; dealers not being inclined to pay this price. Ordinary London makes can be procured on f.o.b. terms at about £11 15s.; and on Beckton terms at £11 13s. 9d. In Leith, the market price remains at about £12. Makers hold out for £12 2s. 6d. to £12 5s., but without success. In Liverpool, the value may be taken at about £11 16s. 3d. to £11 17s. 6d. for prompt. In Hull, some quantity has been sold for forward delivery at £11 16s. 3d., for a fairly good make; and the market still remains at about £11 13s. 9d. for prompt delivery,

COAL TRADE REPORTS.

Lancashire Coal Trade.

Lancashire coal owners remain indifferent to the cries of railway companies and other great consumers who clamour for a reduction in the present charges for coal. There does not, however, appear any likelihood of a change in that direction at present. What is true of Rochdale is no doubt the experience of many similar governing bodies. The Rochdale Corporation have to pay 2s. 7d. per ton more than last year for the 55,000 tons of coal required for their Gas and Electricity Departments. While English coal is being exported at its present rate, with foreigners even having an eye to the possession of some of our coal mines, coal is not likely to be much cheaper. It is reported that a Scotch colliery has been purchased by a German firm of shipping agents. During June, 608,320 tons of coal were received at Hull and shipped abroad, an increase of 153,408 tons compared with June last year; while the half-year's tonnage was 2,913,648 tons, an increase of 593,840 tons. Trade in Lancashire continues very satisfactory. The pits are nearly all working full time. The miners are seeking another advance of 5 per cent. in wages, which is under the consideration of the Coal Conciliation Board. Prices show no change from the last published quotations.

Northern Coal Trade.

There has been rather more irregularity in the coal trade of late. The demand has been generally good for the season; and with a good supply of tonnage shipments are full. In the steam coal branch, there is a good general inquiry, and the trade has been brisk—the large output being well taken up. Best Northumbrian steams are from 14s. 10d. to 15s. per ton f.o.b. For second-class steams the quotation is from 14s. to 14s. 3d.; and for steam smalls the current price is 10s. to 10s. 3d. As to gas coals, the request for best qualities is full, with firm prices; but other kinds are not quite so brisk. Durham gas coals vary, according to quality, from about 13s. 3d. up to 14s. 6d. per ton f.o.b.—and occasionally to 14s. 9d. A few small contracts have been decided, but there is nothing in the quantity or price to make them important in their effect. Indeed, some of the chief of the gas-coal collieries have now the bulk of their output bespoken for some months to come, which helps to steady the prices generally. In coke, there is a fair demand; and gas coke is kept firm by the limited output. The current quotation for good gas coke is 17s. to 17s. 6d. per ton f.o.b. on the Tyne.

Scotch Coal Trade.

There is no trade report for the past week, on account of the Glasgow Exchange having been closed for the holidays. The ship-

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 221.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Feb. 28	14	Bournemouth Gas and Water 10 p.c. . .	27½—28½	..	4 18 3
51,810	10	,,	7	Bournemouth Gas and Water B 7 p.c. .	16½—17	..	4 2 4
53,200	10	,,	6	Bournemouth Gas and Water Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	,,	12½	Brentford Consolidated	250—255	..	4 18 1
300,000	,,	,,	9½	Do. New . . .	188—193	..	4 18 5
50,000	,,	,,	5	Do. 5 p.c. Pref. .	117—122	..	4 2 0
206,250	,,	June 13	4	Do. 4 p.c. Deb. .	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41—43	..	4 13 0
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c. .	119—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c. .	90—93	..	4 16 9
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	11—11½	..	6 1 9
250,000	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	25—27*	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	8½—9½	..	4 14 9
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord. . .	109—111	..	4 10 1
1,443,280	Stk.	,,	5 2/10	Commercial 4 p.c Stk. .	105—108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do. .	102—105	..	4 15 3
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk. . . .	—	..	—
55,000	,,	Jan.	4	Do. Deb. Stk. . . .	—	..	—
486,090	10	Jan. 31	12†	European, Ltd. . . .	23½—24½	+½	4 18 0
354,060	10	,,	12†	Do. £7 10s. paid	18—19	..	4 14 9
5,203,110	Stk.	Feb. 14	4 1/10	Gas-light and Coke 4 p.c. Ord. . .	95—97	..	4 10 10
2,600,000	,,	,,	3½	Gas-light and Coke 3½ p.c. max. . .	88—90	..	3 17 9
3,799,735	,,	,,	4	Gas-light and Coke 4 p.c. Con. Pref.	104—107	..	3 14 9
4,193,975	,,	June 13	3	Gas-light and Coke 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental .	173—176	+2	4 10 11
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c. .	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A . .	221—223	..	4 9 8
718,100	,,	,,	7	Do. B. .	164—165	..	4 4 10
144,140	Stk.	Feb. 14	7⅝	Maidstone 5 p.c. . .	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb..	100—102	..	4 18 0
250,000	100	,,	4½	Met. of Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 9
1,775,892	Stk.	Feb. 28	4⅝	Newc'tle & G'tesh'd Con.	108—109	+½	4 4 10
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	94—94½	−¼	3 14 1
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd. . . .	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd. . .	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord. . . .	6¾—7¼	..	4 16 7
796,980	5	Jan. 31	5	Do. 5 p.c. Pref. .	5—5¼	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb. .	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord. . . .	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd. . . .	12¾—13¼	+¼	6 0 9
125,000	50	July 1	5	Do. 5 p.c. Deb. .	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	245—247	..	4 1 0
209,984	,,	,,	10	Do. B	245—247	..	4 1 0
523,500	,,	,,	10	Do. C	245—247	..	4 1 0
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,350,000	Stk.	Feb. 14	5½	South Met., 4 p.c. Ord.	120—122	+1	4 10 2
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	82—84*	+1	3 11 5
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	157—159	..	5 0 8
605,000	Stk.	Feb. 28	5½	S'th Suburb'n Ord. 5 p.c.	117—121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 1 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	123—128*	..	3 18 2
502,310	Stk.	May 15	5	Southampton Ord. . .	105—110	..	4 10 11
120,000	Stk.	Feb. 28	6½	Tottenham and Edmonton A 5 p.c. .	123—126	..	5 3 2
398,940	,,	,,	5	Tottenham and Edmonton B 3½ p.c. .	100—103	..	4 17 1
137,500	,,	June 27	4	Tottenham and Edmonton 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	106—108	..	4 12 7
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c. . .	—	..	—
255,636	,,	,,	6½	Wandsworth and Putney B 3½ p.c. . .	131—136	..	4 15 7
75,000	,,	,,	5⅗	Wandsworth and Putney C 3½ p.c. . .	—	..	—
79,416	,,	June 27	3	Wandsworth and Putney 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Feb. 28	5⅛	West Ham 5 p.c. Ord. .	102—105	..	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 1 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div." † Next dividend will be at this rate.

ments for the week amounted to 313,091 tons—a decrease of 24,348 tons upon the preceding week, but an increase of 38,404 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,656,677 tons—an increase of 465,906 tons upon the corresponding period of 1906.

Gas-Meter Testing in Edinburgh.

We have received from the Official Inspector of Gas-Meters in Edinburgh (Mr. William Gordon) his report on the working of the department under his control in the year ended the 15th of May last. It shows that the number of meters tested was 87,616—being 16,794 wet and 70,822 dry; and fees to the amount of £2430 were collected. The total number of meters tested by the department since its institution in 1861, up to and including the 15th of May last, was 2,167,231; the fees received for this period being £64,112. During the twelve months there were tested and examined all the gas-meters fixed at the Government Military Depôts in the Midlothian district. The circulation of the prepayment meter continues to increase; and figures are presented in an appendix showing the exact number of automatic meters tested and examined during the past year. The new automatic meters numbered 36,370, or 41·51 per cent., and those repaired 7406, or 8·45 per cent. A cash statement appended to the report shows a profit of £990 on the year's work.

Explosions in Street-Boxes.

The Highways Committee of the Wandsworth Borough Council reported on Monday last week that they had received replies to a letter written by the Town Clerk, at the instance of the Wandsworth and Putney Gas Company, on the subject of explosions caused by accumulations of gas in telephone, electric light, &c., street-boxes. The County of London Electric Supply Company, Limited, stated that they were working under Board of Trade regulations, and proposed to continue to do so, and that notice was given to the Gas Company when leakages were detected. They suggested that the Gas Company should be called upon to keep their mains in effective condition, and to give notice of the laying and alteration of mains, as is done by the Electric Supply Company with regard to their works. The National Telephone Company said the practice of filling manholes with removable material, as suggested by the Gas Company, was abandoned some years ago, and it was their practice to seal up the ends of the pipes running into manholes. They promised that the manholes in the borough should be at once inspected, to ensure that this practice was being efficiently carried out. The London United Tramways, Limited, wrote to the effect that their cables were laid on the solid system, and they did not consider it practicable to fill the street-boxes with a removable material, as suggested by the Gas Company.

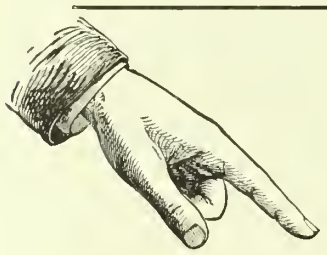
Limerick in Darkness.—Owing to a strike of lamplighters at Limerick, the city was left in semi-darkness last Friday night. Unfortunately a dense fog hung over the streets, and added to the difficulty of pedestrians and others. The trouble continued on Saturday and Sunday nights.

Assessing Water Companies for Income-Tax.—At the annual conference of the National Urban District Councils' Association held last week at Ventnor, the Executive Committee submitted the opinion of Mr. Danckwerts, K.C., upon the legality of assessing water-works undertakings for income-tax upon profits. He upheld the arguments of the surveyors of taxes that a water-rate chargeable only upon consumers was a non-compulsory rate and therefore liable to assessment; and he stated that only the receipts from compulsory rates were untaxable.

Additional Capital for the Uxbridge Gas Company.—At the Mart, Tokenhouse Yard, E.C., last Wednesday, Mr. Alfred Richards offered for sale, under instructions from the Directors, a new issue of £6000 of consolidated stock of the Uxbridge Gas Company, under the provisions of their Act of last session. The stock ranks for a standard dividend of 5 per cent., subject to the sliding-scale; and it is entitled, in view of the dividends last paid by the Company, to 4½ per cent. per annum. It was sold at prices ranging from £86 to £87 per £100; the purchasers taking the dividend accruing from the 31st prox.

Gas-Meter Testing at Reading.—The Inspector under the Sales of Gas Acts to the Corporation of Reading (Mr. Henry Wright) has presented to the Highways and Lighting Committee his report for the year ending the 31st of March last. In this period he had 1050 meters submitted to him; 523 being 5-light, 367 10-light, 105 20-light, and the remainder ranging from 30 up to 150 lights. The meters were tested, and 1029 were found correct and were stamped, while 21 were rejected. Of those stamped, 284 were absolutely correct, 655 averaged 0·91 per cent. slow, or in favour of the consumer, and 111 were 0·75 per cent. fast, or against the consumer. Mr. Wright considers that this is a very satisfactory result. Sixteen meters were submitted for special testing in disputed cases by the Reading Gas Company, and four by the Goring Gas Company; and certificates were given in all cases.

Conservation of Catchment Areas.—At the recent congress of the Royal Institute of Public Health, held at Douglas (Isle of Man) under the presidency of Lord Raglan, a paper, entitled "Some Notes on Water Supplies from Catchment Areas," was read by Mr. Thomas Duncanson, M.Inst.C.E., the Assistant Water Engineer to the Liverpool Corporation, who said if the population of England continued to increase at the rate it had done of late years, it would be absolutely necessary that large areas of country should be set apart for the supply of water—"water farms," in fact—to be kept free from agricultural manure and other contaminations. The purchase of catchment areas by water authorities, the cessation of the cultivation of arable land on them, planting in connection with afforestation, and the general use of the catchment areas as sporting and grazing lands, were all steps towards the production of the "water farm," which, as its chiefest product, should aim at producing pure water.



Hot Water Difficulty Solved!

Can we supply you with our "NEPTUNE" Booklets, for counter use, etc.?

View of Kitchen showing Richmond's "NEPTUNE" Heater fitted to existing hot-water circulating system.

Advertisement of the RICHMOND GAS STOVE & METER CO., LTD.

London Offices and Show-Rooms: 132, Queen Victoria Street, E.C. General Offices and Works: Warrington, &c.

Selby's New Water-Works.

Last week the "Globe" published an article entitled "Selby Abbey Revisited;" and this led Mr. Percy Griffith to write to our contemporary for the purpose of pointing out that, beyond the provision now being made by the Abbey authorities for the insurance of the renovated structure [the disastrous fire which occurred last year will be remembered], the Selby Urban District Council are providing a more effective insurance against fire than any fire policy. "I refer," he continues, "to the new water-works which will be inaugurated before the end of the year. In this scheme (for which, in conjunction with Mr. Bruce Gray, the Council's Surveyor, I am acting as Engineer) is included a reservoir containing 800,000 gallons of water and situated on the summit of 'The Barff,' a hill some 140 feet above the surface level in the Abbey precincts. The pressure available from this reservoir will be sufficient to throw a powerful jet of water well above the central tower of the Abbey, without the intervention of any fire-engine whatever; and as a large number of hydrants are already fixed around the Abbey with hose, jet, and all accessories available at a moment's notice, it is almost beyond the range of possibility that this unique and priceless structure can again become a prey to the devouring flames as it was in October last. As 'prevention is better than cure,' so I may reasonably describe this mode of insurance as being more effective than any financial provision, which can only avail after irreparable damage has occurred."

Lead Wool Joints for Gas-Pipes.—We are informed that, as the result of a number of tests, the Consolidated Gas Company of New York have placed with the Lead Wool Company a contract for 100 tons of lead wool, and are now laying considerable quantities of 36, 30, and 24-inch mains, all the joints of which are made with this material.

Suicide by Gas.—By committing suicide while in a very depressed state, for which he was being medically treated, Mr. Thomas Heath, of Penarth, has cut short an artistic career of great promise. Deceased, who was only 31 years of age, and had exhibited various pictures at the Academy, was found dead near an india-rubber tube, the other end of which was over a gas-jet, which was turned full on. He had long suffered from bad health.

Teignmouth in Darkness.—Soon after ten o'clock on Monday night last week, the gas supply in Teignmouth was suddenly cut off. In the absence of the Manager (Mr. J. A. Gray), who was away on holiday, the Chairman of the Gas Committee of the Urban District Council (Mr. W. J. B. Banbury), immediately proceeded to the gas-works, and found that the bell of the governor connected with one of the holders had gone wrong through the valve not acting. This was quickly rectified, and the supply restored in about 15 minutes.

Cost of the London County Council's Electricity Bill.—At the meeting of the London County Council last Tuesday, Mr. N. L. Cohen asked the Chairman of the Parliamentary Committee if he could inform the Council what had been the cost to London of promoting the Council's Electricity Supply Bill, which had been thrown out by a Committee of Parliament. Mr. W. Peel said he could not give the exact figure; but he thought it would be about £8500. The sum of £18,000 had been provided in the estimates for the costs of the measure. He added that they had lost the Bill, but they had saved their money.

Arbitration as to a Reservoir Site.—At the Surveyors' Institution a few days ago, arbitration proceedings were held to determine the amount to be paid to Mr. Deakin for 64 acres of land which the Bolton Corporation propose to acquire for the purposes of a reservoir. Sir E. Boyle was Arbitrator for the claimant, and Mr. G. H. Hill for the Corporation; Mr. A. E. Fair being the Umpire. The amount given by the claimant's witnesses was about £19,700; Mr. James Watson, of Bradford, for the Corporation, put the full value at £3213, and the other witnesses at something between this and £4000, on the ground that the land was only agricultural. The award was reserved.

"Everybody uses gas-stoves nowadays, and there is no use for us," said a sweep at the Brompton County Court a few days ago.

According to the "Daily Express," Mr. C. Snelling, the Manager of the Thetford Gas-Works, while digging in his garden, uncovered an ancient coffin of Ancaster or Barnet stone. The lid was 6 inches thick, and bore a carved cross; and the coffin contained the complete skeleton of a man 6 ft. 2 in. tall.

Last Saturday week, the Fittings Department of the Wolverhampton Gas Company had their annual outing; the destination being Portsmouth and the Isle of Wight. After dinner at the former place, a vote of thanks was passed to the Gas Company for the treat, and to the Manager (Mr. P. G. Winstanley) for his kindness to the men.

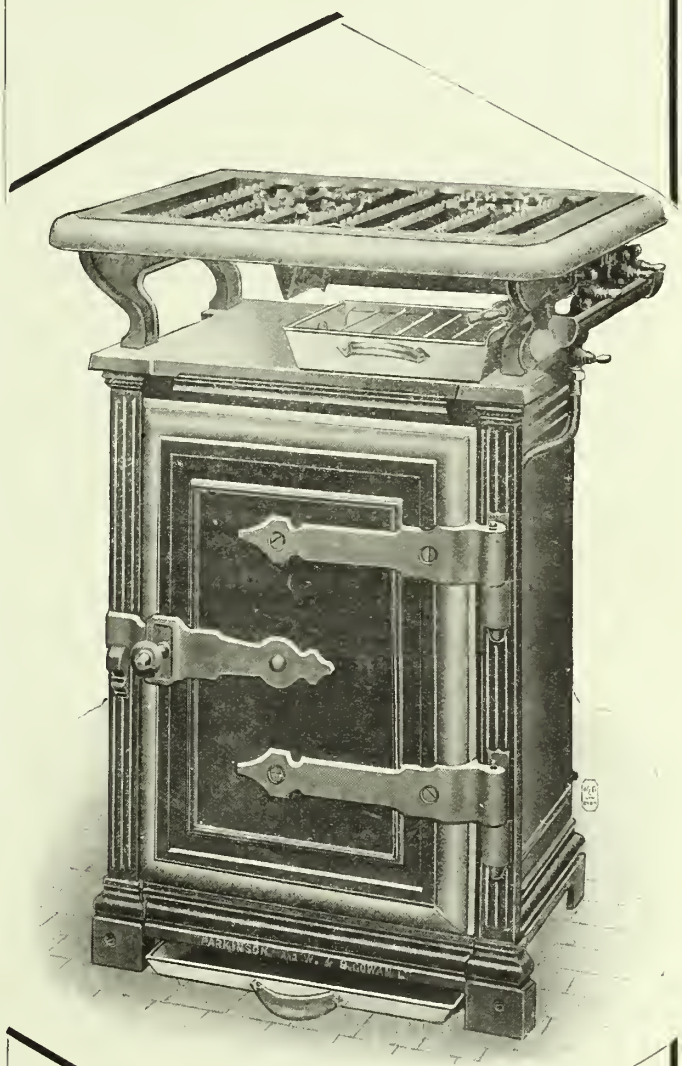
There was an electric light failure—happily of only short duration—at Tunbridge Wells last week. Both indoor and outdoor lights were affected; and at the Opera House, the management had good reason to congratulate themselves on their foresight in having provided gas-jets "in readiness for emergencies." On the Pantiles, a minimum amount of inconvenience was experienced, as gas is there used for street lighting purposes.

We learn that the Thwaite patent tar road-surfacing machines are to be employed on the roads in different parts of the country with the view to the prevention of dust. The machine has already afforded proof of its value in Derbyshire, Lincolnshire (it was applied to the processional roads to the Royal Show at Lincoln), Berkshire, and Surrey. The machine is self-contained; and the tar is applied at a high temperature.

Messrs. Joseph Taylor and Co. have received an order for saturators, together with sulphate-drainer, acid-tanks, sulphate-stores, &c., in connection with sulphate plant which is about to be erected for the Dumfries Corporation Gas Department and the Shanklin Gas Company. The firm have also received orders for a complete plant, including stores, saturator, lining of foundation, &c., for the Horley Gas Company. A further repeat order has been received for three solid plate lead saturators, fitted with duplicate ammonia and acid pipes, for Australia, ordered by Messrs. John Terry and Co.

PARKINSON'S

COOKERS.



NEW DESIGNS.

Particulars on Application.

PARKINSON AND W. & B. COWAN, LTD.
(*Parkinson Branch*),

COTTAGE LANE, CITY ROAD, LONDON.

BELL BARN ROAD, BIRMINGHAM.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GAS ENGINEER AND MANAGER. Morecambe Corporation. Applications by July 25.
WATER-WORKS INSPECTOR. "J.," Victoria Street, S.W.

Situations Wanted.

ENGINEER (DANISH) IN CONVEYOR AND TRANSPORT WORKS. No. 4800.
GAS AND WATER ENGINEER. No. 4798.
MANAGER OR MANAGER AND SECRETARY. No. 4801.
REPRESENTATIVE. H. Classing, Loughborough Road.

Patent for Disposal.

COMPRESSED GAS. Rosenberg and Goldschmidt, Hamburg.

Tar Works for Sale. No. 4799.

Plant (Second-Hand), &c., for Sale.

GAS ENGINE, &c. "G. S.," c/o West End Advertising Agency.
ENGINE AND PUMPS. No. 7854, c/o J. W. Vickers & Co.

Plant (Second-Hand) Wanted.

SCRUBBERS AND WASHERS. "Gas-Works," c/o Vickers.
CONDENSER, EXHAUSTER, SCRUBBER, WASHER, AND PURIFIER, &c. No. 4797.

Company Meetings.

BRENTFORD GAS COMPANY. Westminster Palace Hotel. Aug. 2. 2.30 o'clock.
BROMLEY GAS CONSUMERS' COMPANY. Bell Hotel, Bromley. Aug. 13. Six o'clock.
GASLIGHT AND COKE COMPANY. Chief Office. Aug. 2. Twelve o'clock.
SOUTH METROPOLITAN GAS COMPANY. Cannon Street Hotel. Aug. 14. Two o'clock.
SOUTH SUBURBAN GAS COMPANY. De Keyser's Hotel. Aug. 9. Three o'clock.

Prospectus.

BAHIA BLANCA GAS COMPANY.

TENDERS FOR

Coal and Cannel.

BATLEY GAS DEPARTMENT. Tenders by Aug. 12.
COCKERMOUTH GAS DEPARTMENT. Tenders by July 29.
EAST RETFORD GAS DEPARTMENT. Tenders by Aug. 3.
STRATFORD-ON-AVON GAS DEPARTMENT. Tenders by Aug. 17.

Gasholder and Tank.

THURLES GAS COMPANY. Tenders by July 29.

Pipes and Specials.

COVENTRY WATER DEPARTMENT. Tenders by July 30.
RADCLIFFE AND PILKINGTON GAS COMPANY. Tenders by Aug. 6.

Tar and Liquor.

RHYL GAS DEPARTMENT. Tenders by July 31.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in advance. If credit is taken, the charge is 25s. a year.

Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE,

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

STEAM (all Types, all Sizes) Boilers.
Vertical, Loco., Cornish, Launch, Field-tube; also AIR RECEIVERS, FEED-WATER HEATERS, CYLINDERS, &c.
GRANTHAM BOILER & CRANK CO., LTD., GRANTHAM.

GAS OILS.
MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

DUTCH OXIDE OF IRON.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

THE First Dutch Bogore Co., Ltd.,
HOLLAND.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON,
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

BENZOL
AND
CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.

For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.,
7, BISHOPSGATE STREET WITHOUT,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

OXIDE OF IRON.
(NATURAL.)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS
BALE & CHURCH,
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

TEMPERLEY TRANSPORTERS
FOR Rapid and Economical Handling of Coal and Coke in Gas-Works.
Next Illustrated advt. will appear on Aug. 13.
TEMPERLEY TRANSPORTER COMPANY,
72, BISHOPSGATE STREET WITHIN, LONDON, E.C.
Telephone: 365 LONDON WALL. Telegrams: "TRANSUMO."

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

INCREASE YOUR MAKE.
SEND for Particulars of the "RAPID" Carburettor. Why be short of Gas when you can stretch the make from 1000 to 2000 cubic feet per ton, without any difficulty?
BIGGS, WALL, & Co., 13, Cross Street, Finsbury Pavement, LONDON.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

GAZINE—A radical Solvent and Preventative of Napbthalene deposits, and the Automatic cleaning of Mains and Services.
It is also used for the Enrichment of Gas, and has an illuminating value double that of 90 per cent. Benzol.
Supplied by C. Bourne, West Moor Chemical Works, Killinoworth, or through his Agent, F. J. Nicol, Pilgrim Street Chambers, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. Blakeley, Gas Engineer, Thornhill, Dewsbury.

BRISTOL RECORDING GAUGES AND THERMOMETERS.

J. W. & C. J. PHILLIPS, 23, College Hill, London, E.C., and 7, Park Square, Leeds.

"NUGEPE" GAS PLANT CEMENT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market,
Can be Exchanged for Spent Oxide.
Read Holliday and Sons, Ltd., Huddersfield.

A WELL-KNOWN and Successful Gas and Water ENGINEER, who has just returned from abroad, requires a POSITION as such, or with a firm doing business with Gas and Water Undertakings.
Address No. 4798, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

A GENTLEMAN (Danish Engineer) 1½ Years with the Berlin Anhaltische Maschinenbau A. G.), desires a POSITION in an English Works for Transporting and Conveying Plant. Good knowledge of English and perfect German.
Address No. 4800, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ADVERTISER (aged 36, abstainer), at present successfully Managing small Gas-Works, would like to make a change, and is open to ENGAGEMENT as MANAGER, or MANAGER AND SECRETARY, of 10 to 20 Million feet Works. Good Testimonials and References.
Address No. 4801, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

MR. HENRY CLASSING begs to announce that bis Engagement as REPRESENTATIVE for Messrs. Moffats Limited, has terminated, and now seeks Similar Position with a Firm connected with the Gas Industry. Ground covered North and South East of England and London. Salary or Commission.
Address Millers Dale, Loughborough Road, London, S.W.

WANTED, a Water-Works Inspector. State Age, Experience, and full Particulars, by letter only, to "J," 1, Victoria Street, Westminster, S.W.

MORECAMBE CORPORATION.

GAS ENGINEER AND MANAGER.

THE Council of the Borough of Morecambe require a GAS ENGINEER AND MANAGER to Take Sole Charge of the Morecambe Gas-Works and Undertaking.
He is to enter upon his duties as early as possible.
Salary £150 per Annum, with House, Fuel, Rates, and Gas Free.
Applications, stating Age and Experience (accompanied by *copies* of not more than Three Testimonials), to be sent to me in sealed envelope, endorsed "Gas Manager," on or before the 25th of July, 1907.

Wm. Tilly,
Town Clerk.

Town Hall, Morecambe,
July 9, 1907.

WANTED (Second-Hand), for 20,000 cubic feet per diem Plant, Water-Cooled CONDENSER, EXHAUSTER, SCRUBBER, WASHER, and PURIFIER, all with Ordinary and Bye-pass Valves complete.
Particulars and Offers of the whole or part to No. 4797, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

THE UNIVERSITY OF LEEDS.

DEPARTMENT OF FUEL AND GAS ENGINEERING.

THE New Building of the above Department WILL BE OPEN for the reception of Students on Oct. 1, 1907.
For Particulars respecting Degree and Diploma Courses in Gas Engineering, see Special Prospectus to be obtained on Application to the Registrar.

RESEARCH FELLOWSHIP.

Applications are invited up to Aug. 10, for an Open Fellowship of £100 per Annum, established by the Institution of Gas Engineers for the encouragement of Research in the Chemistry of Gases and Combustion.
For Particulars, apply to the Registrar.

WANTED, Good, Sound, Second-Hand SCRUBBERS and WASHERS, Cast-Iron preferred, both capable of dealing with 50,000 to 100,000 feet daily.
Address "Gas-Works," care of J. W. Vickers and Co., 5, Nicholas Lane, E.C.

TO BE SOLD—A Tar-Works, with good Contracts. Owner going abroad.
Address No. 4799, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ENGLISH Patent for Compressed Gas, offering Great possibilities, TO BE SOLD. Is now being well introduced in Germany.
Further Particulars sent free on Application to Rosenberg and Goldschmidt, Finanzierungsbureau, Hamburg, Germany.

FOR SALE—A 50-Horse Power Stockport GAS-ENGINE, Single-Cylinder Type, fitted with Two 7-feet Fly-Wheels and Outside Bearings on each end of Crank Shaft. Complete with Gas Bag, Silencer, Meter, Exhaust Piping, &c.
Apply to "G. S.," care of West End Advertising Agency, 195, Oxford Street, W.

FOR SALE—The undermentioned good, Second-Hand Gas Plant:
KIRKHAM'S WASHER-SCRUBBER to pass 250,000 cubic feet per diem.
TWO DONKIN'S EXHAUSTERS, 10,000 and 8000 cubic feet per hour.
GAS-VALVES, 12 inch, 10 inch, 6 inch, and other sizes.
Apply to Samuel While and Son, 60, Queen Victoria Street, London, E.C.

FOR SALE—The following Water-Works Plant:—One Worthington Duplex High-Pressure ENGINE AND PUMP, 12-inch Steam Cylinders, 7-inch Pump Plungers, 10-inch Stroke, capable of lifting 13,000 Gallons per hour to a height of 350 feet. One Worthington Triple-Expansion Surface Condensing PUMP, capable of raising 12,600 Gallons per hour to a height of 350 feet.
For further Particulars, Address No. 7854, care of J. W. Vickers and Co., 5, Nicholas Lane, E.C.

BOROUGH OF EAST RETFORD.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the Supply of 7000 Tons of Screened GAS COAL or NUTS to be delivered at the Sidings of the Great Northern or Great Central Railway during the Year ending July 31, 1908.
Forms of Tender may be had, with any further Information, from the undersigned.
Sealed Tenders, endorsed "Tender for Coal," are to be addressed to the Chairman of the Gas Committee on or before the 3rd of August, 1907.
The Committee reserve the right to accept the lowest Tender or any portion of the quantity offered.

J. B. Fenwick,
Engineer and Manager.

Gas and Water Offices,
Grove Street, Retford.

BOROUGH OF BATLEY.

THE Corporation are prepared to receive TENDERS for the Supply and Delivery at their Gas-Works of 20,000 Tons of Screened GAS COAL.
Conditions and Form of Tender may be obtained on Application to the Manager at the Gas-Works.
Sealed Tenders, endorsed "Tenders for Gas Coal," to be delivered to me on or before Monday, the 12th of August prox.
The Corporation do not bind themselves to accept the lowest or any Tender, and may accept any Tender for a part only of the Specified Quantity.

By order,
J. H. Craik,
Town Clerk.

Town Hall, Batley,
July 18, 1907.

RHYL URBAN DISTRICT COUNCIL.
(Gas Department.)

THE above Council invite Tenders for the Surplus TAR and LIQUOR produced at the Gas-Works for One, Two, or Three Years from the 1st of August, 1907.
The Estimated quantity of Tar is upwards of 300 Tons, and of Liquor upwards of 600 Tons.
Delivery into Contractor's 200-Gallon Tanks at Rhyl Station.
Sealed Tenders, addressed to the undersigned and endorsed "Tenders for Tar and Liquor," to be delivered not later than the 31st of July, 1907.
The Council do not bind themselves to accept the highest or any Tender.

Arthur Rowlands,
Clerk to the Council.

Council Offices, Rhyl,
July 16, 1907.

RADCLIFFE AND PILKINGTON GAS COMPANY.

PIPES AND SPECIALS.

TENDERS are invited for the Supply of 100 6-inch Spigot and Socket CAST-IRON GAS MAINS and a number of SPECIALS.
Further Particulars may be obtained from the undersigned, by whom Tenders will be received until Tuesday the 6th day of August next

James Braddock,
Manager and Secretary.

Gas Offices, Radcliffe,
July 17, 1907.

THURLES GAS COMPANY.

A Steel Tank and Double Lift Gasholder Required, 35 feet diameter.
Forms of Tender, Drawings, Specifications, terms of Agreement, Conditions of Contract, Quantities, and all Particulars may be obtained from the undersigned, the Engineers to the Company, on or after Monday, July 22, on payment of Half-a-Guinea.
Tenders to be submitted on or before noon on Monday, July 29, 1907.

Anderson Bros.

5, Westminster Chambers,
London, S.W.

STRATFORD-UPON-AVON CORPORATION.
(Gas Department.)

THE Gas Committee invite Tenders for the Supply of 5000 Tons of Good Screened GAS COAL or NUTS, for delivery during the Twelve Months ending Sept. 30, 1908.
Forms of Tender and other Particulars can be obtained upon Application to the Engineer and Manager.
Tenders to be sent in (and will be accepted only on the Forms supplied) not later than Aug. 17, 1907.
The lowest or any Tender not necessarily accepted.

J. S. Cranmer,
Engineer and Manager.

July, 1907.

COCKERMOUTH URBAN DISTRICT COUNCIL.

THE Gas Committee of the above Council invite TENDERS for the Supply of 2300 Tons of Best GAS COAL, to be delivered at the Cockermouth Goods Station in such quantities as may be directed before the 30th of June, 1908.
Tenders, endorsed "Coal," addressed to the Chairman of the Gas Committee, must be delivered not later than noon on Monday, the 29th day of July, 1907.
Particulars and Tender Forms may be had on application to the undersigned.

A. F. Young,
Gas Manager.

July 12, 1907.

CITY OF COVENTRY WATER-WORKS.

SHUSTOKE SUPPLY.
TO PIPE FOUNDERS.
Contract Nos. 8, 9 and 10.

THE Corporation of the City of Coventry are desirous of receiving TENDERS for the Making and delivery of about 8 miles in length of 20-inch and of about 4 miles of 16-inch, internal diameter, CAST-IRON PIPES, together with certain other PIPES and SPECIAL CASTINGS.
Specification and Forms of Tender may be obtained, on payment of Two Guineas, returnable if a *bonâ-fide* Tender be made, at the Office of the City Treasurer, Bank Chambers, Coventry, and at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Monday, the 22nd day of July inst.
Tenders must be delivered at my Office, 10, Hay Lane, Coventry, at or before Ten o'clock in the Forenoon of Tuesday, the 30th day of July inst.
The Corporation do not pledge themselves to accept the lowest or any Tender.

George Sutton,
Town Clerk.

10, Hay Lane, Coventry,
July 18, 1907.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing such Capital, and also for including in these Periodical Sales Gas and Water Stocks and Shares belonging to Private Owners, can be obtained on application to Mr. Alfred Richards' Offices, 18, Finsbury Circus, E.C.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1902.

NOTICE is Hereby Given, that METROPOLITAN GAS METERS, LIMITED, of Hyson Green, Nottingham, in the County of Nottingham, Manufacturers, seek LEAVE TO AMEND THE SPECIFICATION OF LETTERS PATENT No. 13557 of 1904, granted to Metropolitan Gas Meters, Limited, and John Daniel Forster, for "Improvements in Prepayment Gas-Meters."
Particulars of the proposed Amendment were set forth in the "Illustrated Official Journal (Patents)" issued on the 17th of July, 1907.
Any person or persons may give NOTICE OF OPPOSITION to the Amendment (on Form "G") at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

C. N. Dalton,
Comptroller-General.

This Prospectus has been filed with the Registrar of Joint Stock Companies.

THE BAHIA BLANCA GAS COMPANY, LTD.

(Incorporated under the Companies Acts, 1862 to 1900).

CAPITAL - £300,000,

DIVIDED INTO

46,000 Ordinary "A" Shares of £5 each .. £230,000

AND

70,000 Ordinary "B" Shares of £1 each .. £70,000

£300,000

Out of the profits available for distribution in each year the Ordinary "A" Shares will be first entitled to a non-cumulative dividend of 6 per cent. per annum; then the Ordinary "B" Shares will be entitled to a like dividend of 6 per cent. per annum; the surplus profits will be distributed as to one half amongst the Ordinary "A" Shares and the other one half amongst the Ordinary "B" Shares. The Ordinary "A" Shares will also have a preference as regards capital over the Ordinary "B" Shares, and after repayment of the capital paid up on both classes of shares, will be entitled to one half of the surplus assets, the holders of the Ordinary "B" Shares being entitled to the other half.

Issue of 30,000 Ordinary "A" Shares of £5 each at par,

(Leaving 16,000 Shares for future issue)

PAYABLE—

£1 on Application; £2 on Allotment; £1 on the 31st of August, 1907; £1 as required by Two Months' notice.

Payment in full may be made on Allotment. Interest at 4 per cent. per annum will be allowed on amounts prepaid. The 70,000 Ordinary "B" Shares of £1 each are issued to the Vendor Syndicate as paid up.

Applications from Shareholders of the Buenos Ayres (New) Gas Company, Limited, will receive prior consideration.

Directors.

JOHN CONRAD im THURN (J. C. im Thurn & Sons), 1, East India Avenue, Leadenhall Street, E.C., Merchant.
ROSS PINSENT, 16, Maresfield Gardens, Fitzjohn's Avenue, N.W., Gentleman.
FREDERICK CHARLES im THURN (J. C. im Thurn & Sons), 1, East India Avenue, Leadenhall Street, E.C., Merchant.

} Directors of the Buenos Ayres (New) Gas Company, Limited.

Bankers.

In London—THE UNION OF LONDON & SMITH'S BANK, LIMITED, 50, Cornhill, E.C.
In Bahia Blanca—THE ANGLO-SOUTH AMERICAN BANK, LIMITED, Bahia Blanca Branch.
Solicitors—WALTER WEBB & CO., 31, Budge Row, E.C.
Brokers—WAINWRIGHT & WHITEHEAD, 11, Copthall Court, E.C.
Auditors—ARTHUR GODDARD & CO., 46, London Wall, E.C.
Secretary and Offices—J. M. MACMORRAN, I, East India Avenue, E.C

PROSPECTUS.

The Bahia Blanca Gas-Works (Construction) Syndicate, Limited (hereinafter called the Syndicate), formed on 26th June, 1906, having entered into the contract below mentioned, dated 5th July, 1906, for the acquisition of a permit from the Municipality of Bahia Blanca in the Argentine Republic to instal in the precincts of the City a manufactory of illuminating gas, with the capacity to produce as a minimum 3000 cubic metres in 24 hours, and for the acquisition of a suitable plot of land, about 16½ acres in area, situate in the vicinity of Bahia Blanca, has thereon erected Gas-Works, machinery and plant approaching completion, with a capacity to produce 60,000,000 cubic feet of gas per annum, with manager's house, town offices, shops, stores, stables, &c., and has laid mains in the principal streets, and the undertaking is reported to be practically in order for the supply of gas within about a month from the present time. The Syndicate has also purchased an additional piece of land in the same city upon which offices have been erected. The Syndicate is the promoter of the Company, and its registered office is at I, East India Avenue, London.

By the Contract in this behalf dated the 12th day of July, 1907, referred to below, the Bahia Blanca Gas Company, Limited, acquires from the Syndicate, the permit, the lands and all the works as constructed, and other benefits and rights for £70,000, in fully paid-up Ordinary "B" Shares of £1 each, and £70,000 in cash or Ordinary "A" Shares, fully paid up, at the option of the Company, and £44,530 in cash, these last two amounts being the estimated expenditure of the Syndicate on a cash basis as certified by the Auditors, Messrs. Arthur Goddard and Co., Chartered Accountants, in their Report dated 9th July, 1907, addressed to the Directors of the Company, as follows:—

> We have examined the books, accounts, and contracts of the Bahia Blanca Gas Works (Construction) Syndicate, Limited, and we are of opinion from information placed at our disposal, that the sum of £114,530 0s. 9d. will cover all amounts paid and to be paid on account of the construction, and such stores and appliances as are necessary to commence gas making, so far as is at present contemplated.
>
> It must be understood that there may be some variation either way from this total, and this more particularly in respect of expenses incurred in the erection and construction in Bahia Blanca, and should form the subject of an eventual adjustment account. The amount of same figuring in the before-mentioned total is £26,200.

Bahia Blanca is one of the most rising cities in Argentina; its port and position are such that it promises to become the great shipping centre of the southern portion of the Argentine Republic, and great developments are expected in the uses that will arise there for gas not only for illuminating purposes but for power and cooking.

It will be seen that this Company steps into the enjoyment of an undertaking about to supply gas for an important and increasing Argentine City, upon the terms of repaying the Vendors their expenditure with interest, and in addition securing to them an interest in the profits of the working after the Ordinary "A" Shares have received a dividend of 6 per cent.

It is estimated that after providing for the purchase money and any additional works for completion, there will remain about £20,000 for working capital. The 16,000 Ordinary "A" Shares unissued, are reserved for the future extensions.

The following agreement above referred to has been or will be entered into:—

> Dated 12th July, 1907, between the Bahia Blanca Gas-Works (Construction) Syndicate, Limited, and the Bahia Blanca Gas Company, Limited, being a contract for the sale of the permit and rights therein mentioned, about 16½ acres of land situate in the vicinity of Bahia Blanca, an additional piece of land situate in the City of Bahia Blanca, and the gas-works, machinery, plant, stores, &c., with Manager's house, shops, &c., and town offices erected thereon respectively and the benefit of all contracts entered into by the Syndicate in consideration of the sum of £184,530 payable, as to £70,000 in cash or "A" Shares fully paid-up at the option of the Company, and £44,530 in cash, being the expenditure by the Vendors and interest, in acquiring the said permit, land, erecting the gas-works, plant, etc., of laying mains in the streets and preliminary expenses, and the balance of £70,000 by the allotment to the Vendors of the whole 70,000 Ordinary "B" Shares of £1 each of the Company fully paid up.

The Articles of Association of the Company provide that the Company shall forthwith enter into this agreement and declare that it is to be no objection to the said Agreement that the Directors of the Syndicate are to be the first Directors of the Company, or that, in the circumstances, they do not constitute an independent Board, or that the Syndicate is the promoter of the Company, and that every member of the Company, present or future, is to be deemed to join the Company on this basis.

The Contract under which the Syndicate acquired the permit is dated the 5th day of July, 1906, and made between the Buenos Ayres (New) Gas Company, Limited, of the first part, Messrs. J. C. im Thurn & Sons of the second part, and the Syndicate of the third part.

The contents of the Memorandum of Association and the names, addresses and descriptions of the signatories and the number of shares subscribed for by them will be found in the fold of the Prospectus and form part thereof.

The qualification of each Director is the holding of 100 Ordinary "A" Shares of this Company.

The Articles of Association provide that the Directors, other than Managing Directors, shall be paid out of the funds of the Company, by way of remuneration for their services, at the rate of £200 per annum for each Director and an additional £50 to the Chairman (if any), and they shall be entitled to such further remuneration (if any) as the Company in General Meeting shall from time to time determine.

The Articles also provide that the remuneration of a Managing-Director shall from time to time be fixed by the Directors or by the Company in General Meeting, and may be by way of salary or commission or participation in profits, or by any or all of those modes, and that if any Director, being willing, shall be called upon to perform extra services or to make any special exertions in going or residing abroad or otherwise for any of the purposes of the Company, the Company shall remunerate such Director either by a fixed sum or by a percentage of profits or otherwise as may be determined by the Directors, and such remuneration may be either in addition to or in substitution for his share in the remuneration above provided.

The minimum subscription upon which the Directors may proceed to allotment, as fixed by the Articles of Association, is 25 per cent. of the Shares now offered for subscription.

Although no goodwill exists in the ordinary sense of the word, yet possibly the 70,000 Ordinary "B" Shares of £1 each to be issued to the Syndicate should be treated as for goodwill.

The preliminary expenses are estimated to amount to £3500.

The following Directors of this Company are shareholders in the Syndicate, their holdings being:—

As a Member of J. C. im Thurn & Sons
John Conrad im Thurn } 7,000 Ordinary Shares of £1 each, and
Fredk. Chas. im Thurn } 5,900 "B" Shares of 1/- each.
Ross Pinsent .. .. 500 Ordinary Shares of £1 each, and 50 "B" Shares of 1/- each.

Messrs. John Conrad im Thurn and Ross Pinsent are also Directors of the Syndicate.

The total capital of the Syndicate is £70,700, consisting of 70,000 Ordinary Shares of £1 each and 14,000 "B" Shares of 1/- each, the whole of which has been issued.

The above-mentioned Auditors' Report, Contracts, and Memorandum and Articles of Association may be seen by intending applicants for shares at the Office of the Solicitors of the Company on any day before the closing of the Subscription List, between the hours of 11 a.m. and 4 p.m.

Applications for shares should be made on the form accompanying the Prospectus and sent with the deposit to the Company's Bankers. If no allotment is made the application money will be returned in full. If an allotment is made of a smaller number of shares than that applied for, the balance of the application money will be applied towards the payment of the money due on allotment and any excess will be returned to the Applicant.

Failure to pay any instalment when due will render any instalment previously paid liable to forfeiture.

Prospectuses and forms of application can be obtained from the Bankers, Solicitors and Brokers, and at the Offices of the Company.

Application for a special settlement in, and an official quotation of, the Company's Ordinary Shares will be made in due course to the Stock Exchange, London.

Dated 12th July, 1907.

This Form may be cut out and used.

THE BAHIA BLANCA GAS COMPANY, LIMITED.

No. _____

CAPITAL - - - £300,000,

DIVIDED INTO

46,000 Ordinary "A" Shares of £5 each and 70,000 Ordinary "B" Shares of £1 each.

ISSUE OF 30,000 ORDINARY "A" SHARES OF £5 EACH AT PAR,

PAYABLE

£1 per Share on Application, £2 per Share on Allotment, £1 per Share on the 31st August, 1907, and £1 as required by two months' notice.

To the Directors of the
BAHIA BLANCA GAS COMPANY, LIMITED,
1, EAST INDIA AVENUE, E.C.

GENTLEMEN,

Having paid to The Union of London and Smith's Bank, Limited, 50, Cornhill, E.C., the Company's Bankers, the sum of £_____ being a deposit of £1 per share on application for_____ Ordinary "A" Shares of the above issue, I/we request you to allot me/us that number of shares upon the terms of the Prospectus issued by you, dated the 12th July, 1907, and the Company's Memorandum and Articles of Association; and I/we hereby agree to accept the same or any less number you may allot to me/us, and to pay the further instalments thereon as provided by the said Prospectus; and I/we authorize you to register me/us as the holder of the said shares.

*Signature*_____

*Name (in full)*_____

*Address (in full)*_____

_____

*Description*_____

*Date*_____ 1907.

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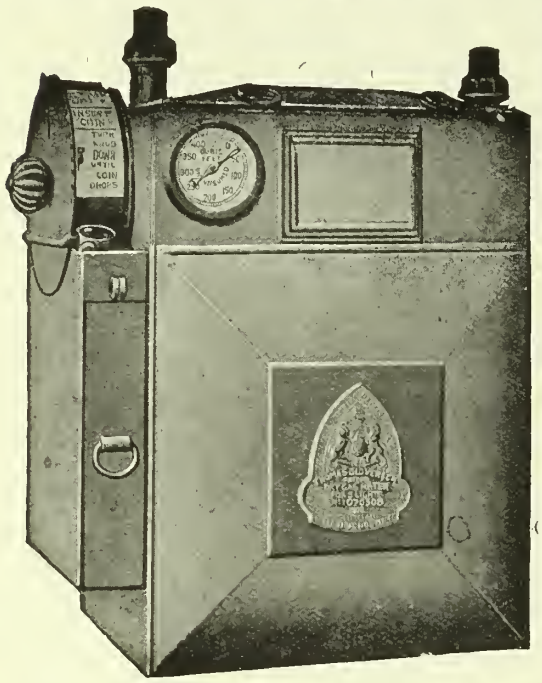

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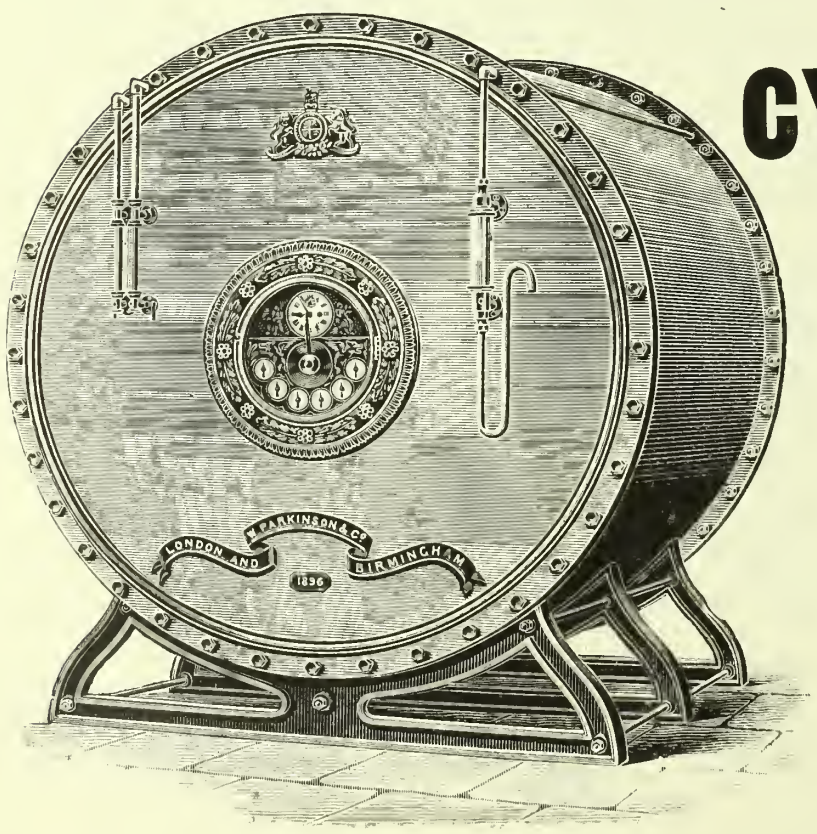

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. XCIX., No. 2307.—TUESDAY, JULY 30, 1907.

EDITORIAL NOTES—GAS, &c.

The Gaslight and Coke Company and their Affairs—Another Excellent Account.

If it were not for the condition of the coal market, the Governor of the Gaslight and Coke Company (Mr. Corbet Woodall) and his colleagues would, so far as the affairs of the undertaking are concerned, meet the proprietors on Friday under a cloudless sky, and with every cause for mutual congratulation. The policy of the Board during recent times may be summed up in the one word Reformation; and reformation there has been in manufacturing work, in trading, and in finance. The results are plainly presented to anyone who cares to look for them in the accounts of the past half year. There is no fear of the assertions being questioned that this is the Company's record account, and that had it not been for the shrewd work of recent times, the Company would have been in a parlous condition for meeting the current twelve months' increase of a quarter of a million in the cost of raw materials. As it is, the Company stand well, in respect of finance and immediate business and general working. The carry-forward into the current half year, after paying the fixed and other charges and dividend, is £96,511 more than a year ago; there will now be revenue from meter-rents at the rate of about £60,000 a year; the sale of gas in the half year has increased by 3¼ per cent., or 352,029,000 cubic feet (this being upon an increase of 3·94 per cent. in the corresponding half of last year); the number of consumers has been augmented by 12,678, and of stoves by 14,203; better prices have been obtained for coke, and, while high prices for coal are maintained, it may be expected that coke will continue to assist in recouping some of the expenditure under this head. Lastly, the further improvement in the working of the manufacturing department is a point of salient importance in the stability of the concern.

Consider these figures. The increase in the quantity of coal carbonized in the half year was only 9023 tons compared with the first half of 1906, and of spirit used 6029 gallons. But, on the other hand, there was a decrease of 120,378 gallons of oil. Bearing in mind these figures, it must be acknowledged, as a notable fact, that the increase in the amount of gas produced was no less than 429,523,000 cubic feet. Then that there were 11,409,000 cubic feet less carburetted water gas made indicates that the improvement was concentrated in the coal gas manufacture; and as the increase in the quantity of coal carbonized is, in its smallness, out of all proportion with the increased amount of gas made, the improvement, it must be recognized, has run through the entire carbonizing operations.

On financial matters, the mere mention that the balance on the half-year's working—after providing for all fixed charges, setting aside £10,000 for the half year towards the redemption fund, and contributing £11,708 to the insurance fund—is £411,206 (an increase of £47,556), that the sum available for distribution is £641,159 (an increase of £96,210), and that the carry-forward is £306,992 (or £96,511 more than a year ago), very inadequately present the real improvement in the financial strength of the Company. The half-year's revenue not only provided £77,000 more than is required for the fixed and other charges and dividend, but it has had to bear some additional heavy burdens, over certain of which the Directors had no manner of control, while others were created in pursuance of the more salutary financial policy. With regard to the former, in small part through the augmented consumption of coal, and in larger part through its higher price, the increase in the cost of coal was £55,831; of oil, £2003; and of coke and breeze used in the manufacture of carburetted water gas, £6459. With respect to the heavier charges attributable to the more salutary financial policy, it is in connection with the distribution department that these are found. At the last meeting of the proprietors, the Governor made an explanation as to the liquidation of an item that has appeared in the balance-sheet for some twelve years—viz., "Automatic meter supplies (fittings account)"—and he announced how the disappearance of this item would give the Board greater liberty in the matter of providing for depreciation on such perishable appliances as meters, stoves, &c. Of this liberty advantage has been taken in the past half-year's accounts. For repair and renewal of meters, an additional £17,541 has been charged in the revenue account, and for repair and renewal of stoves, £14,336; and an entirely new item appears—viz., "Gas-fittings, including labour, automatic meter supplies, £29,258." If we turn to the capital account, a fresh item is also found there, "Depreciation of meters and stoves, £27,589." This, added to the entry for depreciation of plant (£25,855), makes the writings-off on capital account only short by £872 of the capital expenditure in the half year. The capital account is going to benefit in the future from this change; and we are confident it will meet with the approval of all proprietors who look to sound finance as the greatest security they can have for their holdings.

Other items in the revenue account do not claim much attention. In contrast with the first half of last year, purification is again down; the saving in the half year being £12,778. Rents, rates, and taxes have, contrary to the rule of many years, dropped by £7606; but the payment is still the goodly one of £142,373. The income from gas was close on £40,000 more; and in the rearrangement of the accounts, a new entry, "Rental of fittings, £58,545," appears among the items of revenue. Residuals produced £53,089 more; but as coke returned close on an additional £60,000, it follows that the other products receded somewhat in their yield of income.

The account is an excellent one; and the consumers may rejoice with the proprietors that it enables the Board to save them, despite the great rise in the price of coal, from anything worse than the infliction in the coming twelve months, of an extra payment of ¾d. per 1000 cubic feet by the re-imposition of meter-rents. The accounts confirm the opinion previously expressed in these columns, that a better time for re-establishing uniformity in this respect in the Metropolis could not have been chosen by the Board.

International Photometric Congress—A Hint to Electricians.

The second session of the International Photometric Committee, which took place, as reported in the "Journal" last week, at Zürich on the 18th to the 20th inst., was more fruitful of good results than a mere perusal of the Committee's resolutions would indicate. Something approaching finality has been reached in the determination of the precise ratios subsisting between the English, French, and German standards of light; and it is now established, by indirect methods of comparison, that the Harcourt standard has, within the limits of observation, exactly eleven times the value of the Hefner. This is a convenient ratio; and we hope that the ease of conversion will induce English electricians to return the illuminating power of electric lamps which have been tested by comparison with the Hefner lamp in terms of the English standard candle, instead of the delusive so-called Hefner "candle." Let them record in their note-books (better still in their memory) the fact that the Harcourt standard is equivalent to 10 English standard candles or to 11 Hefner units, and that consequently values returned in Hefners should be divided by 1·1 in order to obtain the equivalent in standard candles. The illuminating value of gas, or of gas-burners, is never returned in England in Hefners; and we hope electricians who have hitherto had a liking for the German unit, to which the term "candle" is

frequently misapplied, will now give it up in favour of the true standard candle.

It will be remembered that the Institution of Gas Engineers, at its Dublin meeting, passed a resolution to the effect that "This meeting is of opinion that the 10-candle "pentane lamp and the No. 2 'Metropolitan' argand "burner should be the recognized photometrical standards "for gas up to, and including, 20 candles." The main purpose of the resolution was to equip the Institution's delegates to the International Photometric Congress with some definite authority to support these standards in the name of the Institution. Of the two delegates, Mr. Charles Carpenter was unfortunately unable to attend the Congress; and it fell to his colleague, Mr. James W. Helps, to uphold unaided the British position in the photometry of gas. We say unaided advisedly, for except for the unexpressed sympathy of the Dutch and Italian delegates, and the aloofness of the academical representatives, he had to face general hostility on the question. In view of the fact that the Harcourt standard is not yet ten years old, while the Carcel and Hefner are very much older, we think he was wise in not pressing on this occasion for a resolution of the Congress in favour of its universal adoption. If we mistake not, time will settle the matter; and, in a few years, the Congress will acknowledge, without pressing, the general superiority of the Harcourt standard over the inexact Carcel and the inconvenient Hefner. With the No. 2 "Metropolitan" argand burner, Mr. Helps's difficulty was even greater; for we fancy only one of the foreign delegates had seen the burner before Mr. Helps showed it in use at the Congress. He made it clear, however, that English gas engineers intended to accept this, and no other, as the standard gas-testing burner; and we must rest content for the present with the knowledge that considerable interest was displayed in it by the several representatives of the Continental gas engineering societies on the Committee, and some of them at least intend to try it. That conviction as to its merits will follow trial, we do not doubt.

Curiously enough, an attempt was made to pass, at the instance of some of the French delegates, one or two resolutions to the effect that the calorific power of gas might be correctly taken as a measure of its illuminating value in either self-luminous flames or incandescent burners. If the resolutions had referred only to coal gas, they would perhaps have been passed. But one of the objects of the thesis which M. St. Claire Deville presented to the meeting was to demonstrate the correctness of his theory that the calorific power of any illuminating gas—whether coal gas, water gas, or a mixture—is a true expression of its illuminating value in incandescent burners. Herr Strache was able, through his intimate knowledge of the behaviour of water gas, to controvert this theory; and Mr. Helps, and the German, Dutch, and Italian gas engineers, also refused to accept it without some further proof. The resolutions therefore were dropped, and instead there was passed the non-committal resolution quoted last week (*ante* p. 224) to the effect that experimental researches on the relation of the maximum illuminating power of gas to its calorific power should be conducted in the different countries. It would have been disastrous had the Congress committed itself to the support of an unsubstantiated proposition. Certainly, the suggested researches should prove instructive; and the results may even have important practical bearings on the gas manufacture of the future.

Finally, it is necessary to say a few words on the conduct of the business of the Congress. Such international meetings are always difficult to manage successfully, and pending the time when the English, Russian, and Spanish languages shall have fulfilled their destinies, and the more ephemeral European tongues shall have disappeared as means of practical intercourse, or pending the adoption of "Volapuk," "Esperanto," or some other like "universal" language, difficulty and loss of time must unavoidably ensue from the necessity of the interpretation of what is said in one language into at least two others. Thanks to the generous assistance given by several members of the staff of the Zürich Polytechnic, able interpreters were not lacking on this occasion. Nevertheless, more time was wasted than should have been the case; and the business went through in a disordered and desultory fashion. The Congress requires, in the first place, a Chairman having the ability to arrange the *agenda* of the meeting in proper sequence, and to dispose of the *agenda* and control discussion in a businesslike manner. In the second place, the Chairman should, if possible, have a good acquaintance with the English, French, and German languages, so that he may know at once the purport of any speaker's remarks. In the event of their being irrelevant or superfluous, he would then be in a position to check them forthwith, instead of having to wait till their conclusion to learn their import from the interpreter. Unfortunately, M. Vautier, who presided over the Committee both at its first and its second session, though possessed of many good and amiable characteristics, has neither of the two qualifications which we have named as essential in the Chairman of such an International Congress. The International Committee must certainly choose another Chairman for its third session three years hence, if it does not wish to lose the adherence of the gas engineers, who, the world over, have a more wholesome hatred of irrelevance and waste of time than their academical colleagues. It is not easy to say on whom the choice should fall. From the national standpoint, we speak disinterestedly, for no one of the English members of the Committee has, we believe, the necessary linguistic attainments. The selection of Heer van Rossum du Chattel, if he should be able to attend the next session, would probably be generally acceptable, and should prove quite satisfactory. Other possible selections, if only national jealousies may be ignored, are either M. Lauriol or Professor Bunte. It is desirable that the Chairman should not have too strong a personal interest in any of the subjects which will come under discussion. It may seem premature to refer to this matter now, in view of the fact that the Committee will not meet again until 1910; but it is well to put on record the necessity for a change while the members of the Committee still have a vivid impression of the inconveniences under which their second session was conducted.

Zürich is always a hospitable, interested, and interesting city, and probably nowhere else would such generous and useful aid have been accorded to the Committee. Both the municipal and the Polytechnic authorities deserve hearty thanks for their support and assistance. The Committee acted wisely in deciding to go again to Zürich for its third session. Needless to say, we include Herr Weiss, the Engineer of the Zürich Gas-Works, among the local authorities to whom the Committee are greatly indebted for assistance. At the banquet given to the Committee by the Zürich Corporation, Mr. J. W. Helps took the opportunity to congratulate the city on the possession of an ideal gas-works, in charge of an Engineer of unsurpassed ability—a sentiment which will be cordially endorsed by all who know the Zürich Gas-Works and Herr Weiss.

Points from the North British Meeting.

THERE are very hopeful indications that the meeting of the North British Association of Gas Managers last week, under the presidency of Mr. Lawrence Hislop, will, in the history of the organization, be looked back upon as the turning-point to larger activities. The Association has a history of which the members are legitimately proud; but of recent years there has not been the whole-hearted enthusiasm in the more serious affairs of the Association that its best friends could wish and have wished. To burke the matter, or to rest reposefully in the hope that matters would mend, is not the best way to deal with the trouble of indifference. Mr. Hislop, youngest in the line of Presidents, did not shirk what he conceived, and rightly conceived, to be a responsibility imposed by his position. In one piquant, emphatic sentence, the President, in his address, summed up the position. "If "it were not," he remarked, "for the strenuous efforts of the "few who still take a prominent part in its affairs, the Asso-"ciation would be defunct in a very short time." That is not as things should be; and we cannot but admire the courage of Mr. Hislop in so pointedly discharging what must have been for him a very distasteful duty, but a duty not to be shirked. The justification for his animadversions and for his appeal for the renunciation of indifference and the regeneration of activity was spread before the members in a manner that admitted of no dispute. The responsibility in this matter is an individual one; and it is the sincere hope that the utterances of the President will awaken a response which will declare itself not only in words but in deeds in the near future.

Opportunity is not lacking. To the ordinary technical and administrative work, the junction was effected at this meeting with new roads to activity. A Commercial Section has been established on the lines of those similar sections which are doing such beneficial work in connection with

southward Associations; and what is of immense importance, the affiliation of the territorial Associations of the United Kingdom with the Institution of Gas Engineers has, also on this occasion, been rounded off by the members of the North British Association sinking hollow reasons, and allowing wise counsels to prevail—a resolution being passed which unites the members, as an organization, to, and gives them representation in, all effort emanating from the central body that has for its purpose common industrial and professional benefit. The aloofness of Scotland has been the one breach in unity; and the action of last week will afford universal satisfaction throughout the British gas profession. This we do predict, that now that, by their own volition, they have drawn tighter the bonds with the Institution, it will be found that the fear of blemished dignity has been nothing more than a mirage, which those who feared will be the first to ridicule. In the person of Mr. W. Doig Gibb, the Institution has this year a worthy and eloquent son of Scotland for its President; and the affiliation resolution of the North British Association has therefore a peculiar fitness.

The technical matters that were introduced to the members at the meeting were practical in character and extensive in subject, from the President's address to the last of the three papers read. If we regard the subject-matter from the beginning of gas-works operations, we stumble over this statement in the President's address: "It is a matter for "surprise that, considering the improvements which have "been effected in nearly every other portion of a gas-works "plant, the methods of carbonization have remained the "same as were in use fifty years ago." It would be a matter for great regret if all that has been done in the application of science to carbonization in gas-works had left the system where it was half-a-century ago; and we should not like the statement to go abroad as authoritative or unchallenged. It is our opinion, however, that the statement is not a rooted belief of the President, but that it was penned without due consideration; for in the very next paragraph of his address we find him saying that "if as much attention "were given to getting the best value possible for our re-"siduals as is given to getting a large yield of gas per ton of "coal, considerable benefit would be derived therefrom." It is remembered, too, that the name of Hislop has not been unidentified with improvement in carbonization methods within the last half century. Whether or not, however, the President is convinced as to the past permanency of the system of carbonization, he does concede, in the latter quotation, that, if there has not been improvement, it has not been for the want of trying to effect it; but it is difficult to understand how the larger yields of gas per ton have accrued with the lamented want of improvement. If we for the moment turn to the useful paper of Mr. Alexander Yuill on "The Practical Management of Gas-Works," we find him in harmony with ourselves, and in discord with the President, on this point; for in a very few lines he tells the history of the improvement in carbonization methods, and the economies that have been produced between the time of the old direct-fired settings and the present regenerative setting with its greater number of retorts, up to twelve. The application of the regenerative system of heating to gas-retorts only dates from the early eighties; and from then, too, dates the accretion in production and fuel economy. Therefore, Mr. Hislop must, on this head at any rate, on further consideration, revise his opinion.

Reverting to the advice that is embodied in the President's remark that "if as much attention were given to get-"ting the best value possible for our residuals as is given "to getting a large yield of gas per ton of coal, consider-"able benefit would be derived therefrom," it is to be hoped that no gas manager is so lax in his management as not to get the "best value" possible for his residuals. But if the President means (we do not think he does) that more attention must be devoted to residuals to the detriment of gas yields, then it must not be forgotten by him that gas is, and must always continue to be, the prime commodity of the gas industry, and therefore to its production first consideration must be accorded. Of this, there is proof sufficient to hand. We cannot, as gas manufacturers, ignore the lessons in kindred industries. In the Mond system of manufacture, great attention is paid to the recovery of ammonia; result, a poor gas and a poor coke. In the bye-product coke-oven system, coke is the staple product; result, a poor quantitative production of gas of the quality required for ordinary gas supply. If, however, the President's advice is intended to go no further than obtaining the "best value" possible for residuals while not neglecting to realize the largest yield of gas per ton, then we are decidedly with him.

Allied to this subject of carbonization is the portion of Mr. Yuill's communication treating of the utility of a carburetted water-gas plant. The term "utility" covers the *soi-disant* "collateral advantages" of such a plant; and those collateral advantages have proved so definite in practice that there is no disputing them. But such advantages are not everything in a commercial industry, where the profit and loss of the manufacturing methods must be the primary consideration. We find in several gas-works the collateral advantages take a very back seat when the coke market is good, and when the price of oil is high, and coal gas can be made at a cheaper rate. With these considerations in mind, the table of costs incorporated in Mr. Yuill's paper should be studied. For the year ending April 30, 1904, he shows a net cost for coal gas only (on a make of 607,900,000 cubic feet) of 12·55d. per 1000 cubic feet; for the year ending April 30, 1906, when 62,341,000 cubic feet of carburetted water gas and 653,610,800 cubic feet of coal gas were made, the net cost for the mixed gas was 10·25d. But the net cost of coal gas that year was 10·03d. per 1000 cubic feet, and of carburetted water gas 12·84d. Where the advantage of the carburetted water gas for that year from the financial standpoint comes in, we are at a loss to understand. The author tells us that, in making comparison, allowance must be made for the higher illuminating value of the carburetted water gas. He does not, however, inform us what were the relative illuminating powers of the coal gas in 1903-4 and 1905-6, and of the carburetted water gas in the latter year; nor does he give any information to show how far the higher illuminating value must be discounted by the lower calorific power. Again, it is not plain from the paper whether Mr. Yuill attributes the lessened cost for repairs on retorts and the saving in carbonizing wages to the assistance afforded by the carburetted water-gas plant; nor is it clear whether the larger total quantity of coal gas made in 1905-6 compared with 1903-4, an increased production per ton of coal carbonized, and changes in the conditions of the coal-gas plant and methods of working, had not something to do with the reduction of the items in comparison with 1903-4. One must have regard to all the circumstances, so as not to do an injustice to the old in endeavouring to make out a good case for the new. Another point that is not made quite plain is as to whether the wages of all the attendants on the carburetted water-gas plant are included in the item "wages, boilers and machinery, 0·96d." Looking at the figures for 1905-6, they seem to form a good argument for the whole of the 715,951,800 cubic feet of gas made that year being produced by the coal-gas plant, and so saving the difference between the coal gas and the water gas of 2·81d. per 1000 cubic feet. It might also have been found that some of the coal-gas items might have been further reduced per 1000 cubic feet by the larger make of coal gas. With his knowledge of Dundee working that we cannot possibly possess, Mr. Yuill can add to the interest attaching to his paper by clearing away the doubt to which the figures may give rise. It is not submitted, however, through the suggestions here, that, in other times and under different market and other conditions, the carburetted water-gas plant would not produce for itself a different financial tale. But the whole story is certainly not told by comparing 1905-6 with 1903-4.

Our friends across the Border are also taking a closer interest in the enemy of the gas manager in other parts of the kingdom—naphthalene—than was their wont formerly. A coal of less richness than cannel and producing gases of greater poverty in solvent properties, has been forced, by a natural order of things, upon the gas makers in Scotland; and the result is that naphthalene is among them, and giving them a taste of its disordering proclivities. Hence it is the subject finds place in the President's address, in Mr. Yuill's paper, and in a contribution by Mr. J. D. Smith, of Stirling, specially treating of one method of preventing naphthalene difficulties. On the general question, there seems a prospect of relief, without adventitious aid, in the vertical retort, or in full charges as under Mr. G. R. Love's plan. But with the orthodox system of carbonization, as we recently remarked, the problem has not yet been solved as to how to avoid in all cases the formation of naphthalene and yet get good carbonizing returns. Therefore, Scotland, like England, has to have recourse to some auxiliary means for dealing with the difficulty beyond the retort-house. The President advises proper attention to the condensing plant; Mr. Yuill, absorption by a suitable oil; and Mr. Smith recounts a satis-

factory result from the use of the Everitt tar-extractor. His experiences are particularly interesting, more especially the one where he found, after the separation of the heavy tar from the lighter oils in the gas, he could, by bye-passing the condensers, accelerate the clearance of deposited naphthalene on the works. The use of retort-house governors came in for prominence at the meeting; and the same benefits that have been secured by their use in England have been realized in Scotland.

The paper by Mr. James Campbell was not of a technical character; but it was instructive, and showed great personal energy, rewarded by success, in breaking new ground in gas supply at Polmont.

Sequel to the South Metropolitan Rating Appeals.

Judging from the array of Counsel before Justices Bray and Lawrence, in the King's Bench Division last Friday, on a motion against a rule calling on the Justices of the County of London to show cause why a writ of *certiorari* should not issue to remove a judgment of the Court of Quarter Sessions into the High Court on an appeal by the South Metropolitan Gas Company against their assessment in various districts, the Justices and the Assessment Committees concerned had taken serious fright over the action of the Company to get set aside a judgment fraught with grave consequences to the gas industry, and particularly to the Metropolitan Gas Companies, in the matter of rating. It will be remembered that the ground upon which the rule was obtained was that Mr. Willoughby, one of the Justices forming the Court, was alleged to be disqualified through (as Chairman of a London Assessment Committee) interest and possibly bias. By "interest," it is not, of course, intended to convey personal pecuniary interest. The arguments on both sides were reasonably submitted to the Court on Friday; but we do not feel—having in view the judgment of the Court of Quarter Sessions, and the common interest that those exercising the functions of assessment authorities have in obtaining judicial decisions converting views and contentions into principles that might possibly thenceforth govern and maintain high assessments—that the question of interest was adequately dealt with. If members of Assessment Committees were altogether disinterested, there would be fewer appeals against their decisions, and fewer reductions on appeal. Justice Lawrence on Friday said that "the law required that every "tribunal should be without interest in the matters in dispute. "This was an invariable principle that should be maintained "at high-water mark." Though the Court has declared Mr. Willoughby to be a person without interest in the assessments of the South Metropolitan Gas Company, and has discharged the rule, everyone has a right to exercise his own opinion—after reading all the arguments addressed to the Court, and remembering the tenor of the judgment of the Court of Quarter Sessions—as to whether the "invariable "principle" has or has not been varied on this occasion.

The Dublin Gas-Testing Case.

In the "Journal" last week (p. 219), we made some comments on the judgment of Mr. Swifte, K.C., the Magistrate who tried the case of the *Dublin Corporation v. Alliance and Dublin Consumers' Gas Company*. We have since learnt that the matter is still *sub judice*, as an appeal against his Worship's decision has been lodged by the Corporation, and is now pending.

Some Practical Hints on Carbonization.

It is some time ago, we believe, since Mr. Corbet Woodall used the phrase about methods of carbonizing being in a state of "fluidity." Certain it is that to-day there are considerable doubt and questioning as to the best means to be adopted for the extraction of gas from coal. In nearly every gas-making country—but principally in England, France, Germany, and the United States—the minds of gas engineers, individually and collectively, are directed to retort-house operations and systems of carbonization. Search the recent transactions of any Gas Association, and it will invariably be found that many have been the papers dealing with various phases of the subject of the distillation of coal. Not so long since, the superiority of inclined as against horizontal retorts used to be a favourite topic for discussion. This still remained in an undecided state, when the newer types of stoking machines added yet another item for consideration. Hardly had these improved machines been introduced, when forms of vertical retorts came prominently into notice, and they remain so still. Connected with these additions to the carbonizing engineer's appliances arose questions as to the advantages of long and heavy or short and light charges of coal. Again following on this was the suggestion of altering the shape and the angle of inclined retorts, and the proposal to charge them all but fully with coal; and yet again, naturally enough, the adoption for gas making of similar practices to those in vogue for coke-ovens was brought forward. Horizontal, inclined, or vertical retorts? Small, continuous, heavy, or intermittent charges? These are still points to which a note of interrogation must be put. But for some time to come the engineer will have to give careful attention to his retort-house plant, on whatever system it may be, so as to see that it is managed in the best possible way, and to be sure he is extracting the highest results that can be obtained from it. It is in this connection that we draw our readers' attention to a French engineer's views on the management of gas-works' regenerative furnaces, whose instructions—or the first portion of them—we give in another part of our present issue. M. Derval's hints are intended to be of an eminently practical character, and to serve the purpose of those who have the actual management and working of retort-furnaces in their hands, and who may not be versed in the deeper and more theoretical aspects of gaseous firing. To them we particularly commend the "instructions" given; for we believe they will be found of interest and of service.

Ratepayers and Gas-Works Purchase.

Seaford is the latest place where the ratepayers have failed to find any attraction in a proposal put forward by the local governing authority for the purchase of the undertaking by which they are supplied with gas—or, at any rate, have not seen sufficient prospective advantage to persuade them to countenance such a scheme. No doubt, the decision was greatly influenced by purely local considerations; and in this connection, it seems that Seaford has suffered the infliction of a "special" water-rate, which has been responsible for a certain amount of shyness at the suggestion of fresh adventure. However, there must always be some particular circumstances applying to individual cases; and it must be confessed that in the present instance everything appears to have been carefully gone into. The Council had adopted the report of a Sub-Committee, in which the opinion was expressed that the gas undertaking in the hands of the ratepayers would largely increase and ultimately become a valuable asset; and that no more advantageous time than the present to purchase would ever occur. The acquisition of the concern at the earliest possible moment was therefore advocated, for which purpose it was suggested that a Bill should be promoted in the next session of Parliament. It was explained that the Company had withdrawn their application for a Provisional Order, which was opposed by the Council mainly on the ground of excessive capital, on which they asked to be allowed to pay 10 per cent. before the consumers could hope for any advantage by way of reduction of price or otherwise; and it was added that the Company had inserted a clause in the Draft Order enabling the Council to buy, "which showed that they were not unwilling sellers." But at the public meeting at which the scheme was rejected—a report of which appears in our news columns—the Chairman of the Company placed this clause in a somewhat different light; for he said it was inserted in the draft merely as the price of the Council's withdrawal of their opposition to the Order, so that it did not in any way constitute the Company "willing sellers." The proposal was thoroughly discussed at the meeting; and it evidently did not commend itself to the great majority of those present—for there were very few votes recorded in its favour. Thus has ended, for the present at least, the Gas-Works Purchase Question at Seaford.

A Small Beginning.

It is a truism that many big things have small beginnings; but the saying can have had few—if any—better illustrations than in the case of the accounts which have come to hand regarding a gas-workers' strike at Limerick. For several days lately, the city was put the maximum of inconvenience in consequence of a dispute at the gas-works (which led to a general strike) over a ladder! If the newspaper reports are accurate—

and they are certainly circumstantial enough to be so—the trouble originated through two of the men acting up to, and even beyond, the best of Trade Union traditions; for, being joiners, they refused to shift a ladder when requested to do so—the ground of their objection being that this was a labourer's work. After this, of course, the trouble grew at such a rate as to put a rolling snowball altogether out of countenance; a great point being made of the fact that the Manager, Mr. Henry Hawkins (who, by the way, as is generally known, is an Englishman), had stigmatized a statement made by one of the men as "a lie." The strike being in full swing, the men proceeded, in the regulation manner, to formulate demands. The one which called for the "discharge of the Saxon" was not exactly characterized by modesty; but it was about on a level with the request that the men should be paid for the time during which they had been idle, and the business of the city had been disorganized. For several nights the streets (with the exception of the few provided with electric lamps) were unlighted; and many of the manufacturers were threatened with a total stoppage of work owing to the failure of the gas supply. Fortunately, however, at length the men saw things in a reasonable light, and returned to work—apparently with both "demands" unsatisfied. In this way the poorer classes of the community have been spared the great amount of needless suffering which would have resulted from the shutting down of the various factories.

Municipal Management at Barry.

Readers of the "JOURNAL" who have followed the references that have appeared during the last few weeks to the Barry Urban District Council gas and water undertakings, will probably not be surprised to learn from the report which will be found in another column of this issue, that public feeling in the town has been considerably stirred by the managerial changes on which the Gas and Water Committee have seemingly set their heart. Desiring some guidance, the Committee engaged Mr. Robert Porter, of Elland, to inquire and report on the management and general administration of the gas and water undertakings. When his report was received, it was found that Mr. Porter regarded the capital of the gas-works as being somewhat excessive, which had naturally militated against a reduction of the price of gas. He urged that alterations and renewals should for some time be paid for out of revenue, so as to place the concern on a sounder financial basis. He also concluded there was considerable room for improvement in the management of the undertaking, and that the management did not receive the consideration from the Committee that was conducive to successful co-operation. As to the latter point, the comment Mr. Porter made was of a most uncompromising character—that "the strained relationship between the Committee and Manager, the unwarranted interference of the Committee in matters of detail, and the utter neglect to act upon the advice given by the Manager in the matter of administration, are responsible for much of the mismanagement." Finally, he expressed the opinion that the administration of the department would be better carried out by an entirely separate Committee, who would spend the meeting time in discussing with the Manager the broader question of finance and administration, results obtained, and the best methods of developing the undertaking, instead of "drawing up pettifogging rules to govern the conduct of their Manager in the discharge of his duties." In the case of the water-works, Mr. Porter again advocated a separate Committee; remarking that having regard to the future requirements, &c., of the two departments, there would be sufficient employment for a separate Engineer and Committee for each of the undertakings. The reports were considered; but the result was hardly what one might have looked for in the circumstances. Instead of taking steps to form two Committees, as suggested, the Committee decided to recommend the Council to terminate the engagements of two servants who for many years have served the town in the capacity of Gas and Water Engineer respectively, and appoint one man to supervise the two undertakings! The Council fell in with these views, though not unanimously; but the ratepayers appear disinclined to stand by silent while Mr. F. M. Harris and Mr. E. W. Waite have such summary treatment meted out to them. A public meeting has already been held, at which a resolution of protest was passed; and it would be anything but astonishing if the matter were not allowed to rest there.

INTERNATIONAL PHOTOMETRIC COMMITTEE.

Second Session at Zurich.

FROM OUR SPECIAL CORRESPONDENT.

(*Continued from p.* 224.)

THE report of the proceedings of the Committee which was given in last week's "JOURNAL" was tolerably complete so far as the first day of the meeting was concerned. But considerations of time and distance prevented the proceedings on the second and third days (Friday and Saturday, July 19 and 20) being dealt with except very briefly; and last week's report may appropriately be supplemented by further particulars.

Referring again to the comparisons of the Carcel, Harcourt, and Hefner standards, there will be seen on another page of to-day's "JOURNAL" [313] a translation in full of the report of the official French investigations prepared by MM. Perot and Janet. Following this, will be found a translation of the supplementary report by M. Laporte on the subsequent confirmatory investigations undertaken on behalf of the French laboratories. Then follows M. Laporte's summary of the results obtained in all the researches —French, German, English, and American. This summary formed the basis on which the Sub-Committee worked in drawing up the final recommendation as to the ratios to be accepted. As the ratios accepted were given last week with an obvious misprint, we take the opportunity of re-stating them correctly—

Carcel . . . . . = $10{\cdot}7_5$ Hefners
Harcourt . . . . . = $10{\cdot}9_5$,,
,, ... = $1{\cdot}02_0$ Carcel
} Probable error ± 1 per cent.

The small figures printed beneath the line are, as already stated, not to be regarded as significant.

Now that all the reports on which these conclusions depend have been published in the "JOURNAL," it may be useful to direct attention to certain points which may in many minds affect the judgment as to whether the International Committee have made a judicious recommendation as to the ratios which should be accepted. So far as we have ascertained, only the French laboratories seem to have taken the trouble to make direct comparisons of the three standards one with the other. The comparisons at the English and German laboratories, and by the American observers, appear to have been all indirect ones made through the intermediary of incandescent electric lamps, as were also other series of comparisons made by the French observers. Now, it is curious that the direct comparisons give a different ratio between the Harcourt and Hefner standards from that given by most of the indirect comparisons and that adopted by the Committee. The direct observations alone make the Harcourt standard equivalent to 1·009 Carcels or 10·72 Hefners. It would be interesting to know whether there was any reason to suspect that the specimens of the standards used for the direct comparisons were abnormal, or, if not, on what grounds the indirect comparisons were preferred.

M. Laporte, commenting generally on the differences between the results of the various observers, remarks that it is difficult to say whether these differences are due to accidental errors of the measurements or to systematic differences between the different specimens of the standards or to different estimates of the atmospheric conditions. This does not seem very satisfactory; and it would have been better if the respective laboratories had carefully checked their standards and photometers one against another, ascertained the personal idiosyncrasies of the observers, and adopted unimpeachable methods of determining the humidity and degree of vitiation of the atmosphere, before they proceeded to multiply indirect observations which possibly are all affected by some common error of procedure. M. Perot was undoubtedly right when he decided to make direct comparisons in order to eliminate any systematic error which the indirect method of comparison may have involved; and many gas engineers will prefer to trust the results so obtained by him and the other French observers. The direct measurements in round figures give a mean value to the Harcourt standard of $10\frac{3}{4}$ Hefners; while the indirect measurements give a mean of nearly 11 Hefners.

GASLIGHT AND COKE COMPANY'S REPORT.

THE following is the report on the working of the Company during the six months ending the 30th of June, which, with the accounts [see p. 337], will be submitted to the proprietors on Friday.

The accounts for the past half year show that, after providing for fixed charges, setting aside £10,000 for the half year towards the redemption fund (in accordance with the provisions of the Company's Act of 1903), and contributing to the insurance fund as shown, there remains a balance of £411,206 6s. 6d. The amount brought forward from the previous half year being £229,952 19s. 11d., there is a total sum available for distribution of £641,159 6s. 5d., out of which the Directors recommend a dividend on the ordinary stock at the rate of £4 8s. per cent. per annum, which will absorb £334,016 19s. 7d. The sum to be

carried forward to the credit of the current half year is £306,992 6s. 10d.

The sales of gas for the half year show an increase of $3\frac{1}{4}$ per cent. over those of the corresponding period of 1906. There has been an addition during the half year of 12,678 consumers, and an increase in the number of gas-stoves sold and let on hire of 14,203.

The satisfactory result of the half-year's working has been contributed to by the increased sale of gas, a better price obtained for coke, and general improvements in working.

The Directors have to report that the contracts for the supply of coal and oil for the next twelve months have been made at prices seriously higher than those of last year, involving an increased expenditure of some £250,000. Of this, however, some portion will be recouped by higher prices obtained for coke.

The Court of Directors has been furnished by the several Engineers of the Manufacturing and Distribution Departments respectively with the usual certificates that all the Company's plant has been maintained in thorough efficiency.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 346.)

The Stock Exchange has had a very poor week again. Business was much restricted, and almost every market was in a depressed condition. Consols set a bad tone. They fell steadily and persistently right through the week. From $84\frac{1}{8}$ on Monday, they came down to $83\frac{1}{8}$ on Saturday—cheaper than a 3 per cent. for money price. The Railways started badly under weather influences, and were carried down by the tide of dulness. The rest in general were also affected, with the exception of the American Market. The depression made itself felt as early as Monday; and a lowering factor next day was the failure of the Japanese Railway loan. Wednesday was somewhat irregular; not uniformly bad, but the changes for the worse were in the majority. On Thursday, Americans were the only silver fringe to the dark cloud. On Friday, there was persistent selling; and the dulness was very marked. On Saturday, the prevailing tone, if not worse, was no better. In the Money Market there was an abundant supply, on which the demands could make but little impression; and easy rates were had. Discount promised at one time to harden a little, but gave way again before the close. Business in the Gas Market has been only about a moderate average on the whole; but one or two of the less frequently dealt in issues came into the market to help the aggregate. The general tendency was steady—there being absolutely no change made in any of the leading issues, or even those which may be said to come next in rank. In Gaslight and Coke, the ordinary was every day moderately active at figures which ranged from $96\frac{7}{8}$ to $95\frac{1}{2}$. A fully proportionate amount of business was done in the secured issues; the maximum changing hands at 89, the preference at from $106\frac{1}{2}$ to $105\frac{1}{2}$, and the debenture at from $83\frac{1}{2}$ to $82\frac{1}{2}$. South Metropolitan was rather quiet, with transactions ranging from 122 to $120\frac{1}{4}$ in the ordinary and from 83 to $82\frac{5}{8}$ in the debenture. A little was done in Commercials; the 4 per cent. marking $105\frac{1}{2}$ and 107, the $3\frac{1}{2}$ per cent. 102, and the debenture 81. In the Suburban and Provincial group, Alliance and Dublin new marked $13\frac{5}{8}$ and $13\frac{11}{16}$, British $41\frac{1}{2}$, Bromley "A" from $119\frac{1}{2}$ to $120\frac{1}{2}$, Hastings $3\frac{1}{2}$ per cent. from $96\frac{1}{2}$ to 98, South Suburban 119, ditto debenture $120\frac{1}{2}$ (a fall of 3), Wandsworth debenture $77\frac{3}{4}$ and $77\frac{1}{4}$, and West Ham $104\frac{1}{2}$. On the local Exchange, South Shields and Tynemouth advanced. Among the Continental Gas Companies, Imperial was quiet at from 173 to 175, Union was done at 112, ditto preference at 136 and $136\frac{1}{2}$, and European fully-paid at $23\frac{1}{2}$. Malta marked $4\frac{1}{4}$. Among the undertakings of the remoter world, Bombay changed hands at $6\frac{5}{8}$ and $6\frac{3}{4}$, Oriental at $142\frac{1}{4}$, Buenos Ayres at $11\frac{1}{8}$ and $11\frac{1}{16}$, Primitiva at $6\frac{29}{32}$ and 7, ditto preference at $5\frac{3}{16}$, ditto debenture at from 95 to $95\frac{3}{4}$, River Plate at $12\frac{7}{8}$, ditto debenture at 94 and $94\frac{1}{4}$, San Paulo at $13\frac{1}{8}$, and Ottoman at $6\frac{1}{8}$.

The recent death is announced of M. Gaston Emmanuel Sautter, a well-known French civil engineer, a member of the Paris Chamber of Commerce, and a Chevalier of the Legion of Honour. Deceased was in his 53rd year.

Some large gas-engines installed at the Edgar Thomson works of the United States Steel Corporation for use with blast-furnace gas have proved so successful that the Company are contemplating an extension in this direction. The Pittsburg Correspondent of "The Times" described in the Engineering Supplement recently some tests which have been conducted to ascertain their efficiency. An interesting feature of these trials was a run of two weeks on the gas as it came from the furnace without the use of the rotary scrubber, and at the end of the run the impurities were removed from the gas passages and valves of the engine. The use of the gas as fuel under the boilers of the blowing-engines has to be supplemented by coal; but it is hoped that, by developing the power in gas-engines, the combustion of the waste gases alone will be sufficient to raise the steam for the blowing-engines. The piping is a formidable feature of such plant, as, owing to the large volume of gas necessary, the mains have to be of great size. Our contemporary thinks everything points to the success of the four-cycle gas-engine for this purpose.

PERSONAL.

The retirement is announced of Mr. John Allen, who for many years filled the position of Secretary of the South-West Suburban Water Company.

Mr. W. Blundell, who a short time ago was appointed Chief Clerk in the Gas Department of the Stockport Corporation, was recently presented by his former colleagues on the Borough Treasurer's staff at Southport with a smoker's cabinet, in testimony of their high regard for him. The heartiest good wishes were expressed for Mr. Blundell's success in his new position.

At the meeting of the Directors of the East Hull Gas Company last Thursday, it was decided that the designation of Mr. John Holliday should in future be General Manager and Engineer of the Company. In connection with this change, Mr. R. Nelson, the Draughtsman and Chemist, has been appointed Assistant Engineer; and there have been a few re-arrangements of the clerical staff.

The "Birmingham Gazette" last Tuesday contained an appreciative notice, in their series of articles on "Midland Captains of Industiy," of Mr. Richard Clayton, J.P., the Chairman and Managing Director of the Cannon Iron Foundries, Limited, with whose application of "porceliron" in the manufacture of gas-stoves many of our readers are familiar. Mr. Clayton has been actively associated with the Company for nearly thirty years.

ELECTRIC LIGHTING MEMORANDA.

An Electric Light Demonstration in the City—Fiction from East Ham—The Osram Lamp Again—Catering for the Working Man—The Profit Surplus and the Hoary Argument—Lightning Causes Further Trouble.

The two Electricity Companies supplying in the City have at length prevailed upon the Public Health Department of the Corporation to allow a demonstration of what the latest forms of electric lamps can do in street lighting. The Companies were stung to the quick by the success of high-pressure incandescent gas lighting in the City; and they have been mighty restless over the matter ever since. Certain it is the City of London Company required something poignant to stir them up to a sense of the indignity of taking £26 per lamp for the melancholy exponents of electric lighting that stood for years in the City streets. This Company are now going to give us a study in light and shade along Holborn Viaduct by means of highly and continuously agitated flame arc lamps, in Farringdon Street by enclosed arc lamps, and in Newgate Street by smaller arc lamps—the charges to be at the rate of £17 10s. each, instead of the existing price of £26 per lamp, with a further reduction for the smaller lamps. And about time too! The Charing Cross (West-end and City) Electric Lighting Company are to be permitted to demonstrate in Cannon Street with centrally hung flame arc lamps, at a cost of £17 10s. If the £17 10s. is the price at which the Companies are willing to carry out the lighting in accordance with sample, it will be interesting to learn more about the other conditions. The Companies have long desired to have this demonstration; and now the opportunity has been granted, they will do their best to make use of it. It is a pity for them that they cannot obtain a decent diffusion of the concentrated light of electric arc lamps. In Cannon Street the flame arcs will show their capability unsupported by such a wealth of shop lighting as obtains in Oxford Street. We do not, however, like the idea of the centrally suspended lamps. There is not room for central standards in Cannon Street; and the City lighting authorities must see to it that every precaution is taken against accident with the strung-up lamps. We suppose, too, sliding ladders on wheels will have to be brought into use—blocking up the centre of already congested Cannon Street—for lamp-trimming purposes. It is noticed that workmen are frequently very busy at the top of the flame arc columns by Blackfriars Bridge; and the lamps in Cannon Street will require just as constant attention. However, the great opportunity has been accorded; and "Lo!" (says the Engineer of the City Company) "the day of salvation draweth near." In the City, where the lighting dwindles off after early office hours, the electricity people can do with as much public lighting as they can get hold of. Hence the struggle.

For fiction, please apply to the "Engineer and Manager, Electricity Works, Nelson Street, East Ham." We have a copy of a circular that this official has issued—a circular which is as barefaced in its exaggeration as anything that has yet been seen in attempts to obtain business by an electricity department. Things must be bad, and the sense of fair play and common justice low, when a man can publish such a circular as the one before us. The householder is asked "Which is the cheaper light—This or That?" and fingers point to an "Osram" lamp in splendid order and a Welsbach burner with the mantle also in good coudition. "Which is the better light—This or That?" is the inquiry on another page, and fingers point to a "Tantalum" lamp in first-rate condition, and a decrepit Welsbach burner with only half a mantle suspended from the prop and with the glass cracked and dirty. It is about as dilapidated looking a thing in the way of an incandescent gas-burner as can be conceived. The intelligent gas consumer will ask, "Who would expect under such

conditions that the new Tantalum lamp would not give the better light;" and "Who fancies that I should keep a burner in such a condition?" Then the author of this piece of exaggeration states that incandescent gas lights are "dirty and poisonous," involve "fire risks, explosions, and black ceilings," and that mantles are difficult to fix. We ask him to reconsider this statement after testing the genuineness of the information contained in our "Illumination Truths" series of leaflets. This statement is also found in the circular: "When successfully mounted and lit," the incandescent gas-burner "is said to give 70-candle power, and burn 4 cubic feet per hour." There is nothing to complain about there, save in the doubt expressed by the "is said." But then the Electrical Engineer and Manager of East Ham, whose want of veracity over this matter cannot gain for him respect, states that "after three hours' burning!" the illuminating power of the incandescent gas-burner "deteriorates 25 per cent., and then only gives about 50-candle power." One scrap of hopefulness for the East Ham Engineer and Manager is found in the corroboration here that the burner did originally yield 70-candle power. He, however, again produces the decrepit-looking burner, and states that that is "as it usually is after a few hours' burning! After 100 hours, if still in existence, the candle power will depend upon the state of dilapidation the mantle is in; and it may give as much as 16-candle power!!" We ask whether the electrical profession generally and the East Ham Electricity Committee in particular countenance such invention, which amounts to distortion? Experienced incandescent gas light users must smile at the man who thinks such misrepresentation is going to deceive them.

Let us see what the East Ham Engineer and Manager has to say on the question of price to make the Osram lamp appear cheaper than incandescent gas lighting. He says that a pennyworth of West Ham gas at 2s. 9d. per 1000 cubic feet will last 7½ hours, using 4 cubic feet an hour. That is true. But he also declares that a pennyworth of gas consumed over that time, will only give an average illuminating power of 30 candles or less. That is untrue. There is no reason whatever why the illuminating power should not be maintained during that period at approximately the original 70 candles. We challenge the "Engineer and Manager" of the East Ham Electricity Department for the reasons and proof of his printed assertion. Now as to the Osram lamp, the circular states that a pennyworth of electricity (32-candle power), at 3d. per unit, will last over 11 hours. Is this the truth, the whole truth, and nothing but the truth? We again say it is not. As was pointed out in the "Electric Lighting Memoranda" last week, the nominal illuminating power of the Osram lamps is stated in Hefner candles; the actual illuminating power is from 26 to 29 candles by British measurement, and the consumption of electricity per hour about 35 watts. Therefore, one lamp would use a pennyworth of electricity, at 3d. per unit, in 9½ hours. But it is found that the voltage at East Ham is 240; and the Electrical Engineer knows perfectly well that at every point of lighting a consumer must use two "Osram" lamps (which will give him an illuminating power of about 55 British standard candles), and so exhaust at each point a pennyworth of electricity in 4¾ hours as against 7½ hours in the case of an incandescent gas-burner consuming 4 cubic feet of gas an hour, and giving an illuminating power of 70 candles. The "Osram" lamp of the nominal 32 (Hefner) candle power costs 4s. every time it has to be renewed; the two lamps at one point of lighting will cost 8s.; and the 8s. must be multiplied by the number of points of use in a house. Why cannot the East Ham Electricity Engineer tell the whole truth about these matters, instead of waiting to be found out by the consumers?

A humorous article has been published in the "Electrical Times" on "Free Wiring and Slot Meters." The humorist is Mr. G. H. Nisbett, M.Inst.E.E. He says that it does not seem obvious to an outsider why supply engineers, with but few exceptions, have made no attempt to obtain a very "lucrative" class of business which lies ready to their hand—viz., the electric lighting of workmen's houses, and the smaller classes of customer comparable with them, by means of slot meters, and the necessary accompaniment of "free" wiring. Later on, he gives two "possible" reasons for the want of attack in force upon this "lucrative" class of business. The first is that "the capital cost of the electric service so much exceeds that of gas supply, as to make the difference between profit and loss on the business;" and the second is that "the working man cannot afford to pay such a price for electric lighting as would be remunerative to the suppliers." Those are a couple of reasons that are not only possible but have an actuality in experience; and the one is found to react largely on the other. That the working man will not, and cannot afford to, pay heavily for an insufficiency of electric light is the reason why the "free" wiring business has proved a failure in so many places—notably at Woolwich. And when to the ordinary price per unit of electricity is added a sum to recompense for the capital outlay on the electricity prepayment installation, and for the extra work in proportion to custom brought upon the department by the prepayment consumer, electricity as a lighting agent is placed far beyond the reach of the working man. Another reason is that electricity slot meters are not yet so reliable that they commend themselves to engineers generally; though this is saying something that directly contradicts a statement by Mr. Nisbett that "reliable slot meters can be obtained for about £2 each." It is that gentleman's belief that 1½d. per unit above the ordinary rate would cover the extra cost of electricity. Suppose the ordinary price is 4½d., the 1½d. additional would make the charge 6d. Mr. Nisbett reckons on a price of 3½d. + 1½d. per unit; and he thinks that five 8-candle power lamps are quite sufficient for a working-man's house—that is to say, an illuminating power of 40 candles (when the lamps are new and the voltage right) spread through the rooms of the house. What is not good enough in the way of illumination for Mr. Nisbett is not good enough for the working man; and for this insufficient illumination Mr. Nisbett expects him to pay £1 11s. 3d. per annum, which works out at 7¼d. per week, or 1d. per day. Now we make out that this will give the working man six hours' use per day of one 8-candle lamp, or if his five 8-candle lamps are used at the same time—and he and his family will want them if they do not desire to spend a wretched existence—he can keep them running for 1¼ hours per day, and then go to bed. Poor working man, and poor wife and family! We should fancy some working men would be inclined to take rather sharp measures with Mr. Nisbett if he insulted them face to face with his proposition, that what is not good enough for him is good enough for them. Supposing the slot meter price of gas is 3s. 6d. per 1000 cubic feet, the working man can purchase 24 cubic feet of gas for 1d.; and he can keep going with that quantity of gas at least four bijou inverted gas-lights of an average 20-candle power for about five hours, or using one only for about twenty hours. Mr. Nisbett has not experienced the slightest difficulty in working down to the ludicrous to make out a case on paper, and in this he does not stand alone among electricians.

The Edinburgh City Council have had their annual discussion as to what should be done with the surplus balance on last year's trading of the Electric Lighting Department. There is only a matter of about £11,000 to be dealt with; and £1055 has been transferred to the reserve fund. The balance of £9919 was the bone of contention. The Electric Lighting Committee were most anxious to use the sum in reduction of moneys borrowed in the past, but which should have been properly charged to revenue. There was the hoary argument, that something should go in aid of the rates as compensation for the cheap money the security of the rates afforded the undertaking. In opposition to this, the axiom may be accepted that the stronger financially a municipal trading undertaking can be made, the greater the security it offers the ratepayers. We also venture to think that the position of the electricity undertaking in favoured Edinburgh is a sufficient security for all the money the department will need. And for the life of us we cannot see why 9000 electricity consumers should relieve the 60,000 non-electricity consumers of ¾d. in the pound. But a majority of the councillors voted for popularity rather than for the financial betterment of the undertaking.

Not long since we reported that a fire had been caused in a church at Blackburn through the fusing of an electric light wire by lightniug. The experience has been repeated at Hereford. During a heavy thunderstorm in the town early last week, a fire was caused at a drapery establishment through lightning fusing an electric light wire. At Wycombe on the Sunday night there was a complete dislocation of the electric light; and wherever that system of lighting had been adopted, the town was in darkness for some hours.

Illuminating Engineering Society of New York.

The first annual convention of the Illuminating Engineering Society is being held to-day and to-morrow at the Edison Building, Boston, Mass. Owing to the number of papers that have been promised, the amount of business that will be necessary to transact at the convention, and the time necessary for recreation, it has been decided that the convention will be opened at 9.30 sharp this morning. To-morrow afternoon and evening it is planned to take the entire convention to the beach, with a shore dinner, for the members, their guests, and ladies. The following is the programme of papers that have already been promised:—

President's Address, Dr. C. H. Sharp.
Check on Reliability of Photometric Curves, J. S. Codman.
Electric Light as Related to Architecture, C. Howard Walker.
Acetylene, A. Cressy Morrison.
What is Street Lighting? W. H. Blood, Jr.
A New Comparison Photometer, Dr. Charles H. Williams.
Primary, Secondary and Working Standard of Light, Dr. Edward P. Hyde.
The Inverted Gas Light, T. J. Litle.
Lighting of the Boston Edison Building, Dr. Louis Bell, L. B. Marks, and W. D'A. Ryan, Committee.
Illuminating Engineering and Central Station Practice, L. H. Scherck.
New Lights and New Illuminants from the Central Station's Point of View, R. S. Hale.
Co-efficients of Diffuse Reflection, Dr. Louis Bell.
School House Illumination, B. B. Hatch.
Illumination of the Engineering Societies' Building, C. E. Knox.
The Elements of Inefficiency in Diffused Lighting Systems; Illumination Photometers and their Use, Preston S. Millar.
The Present Status of Candle Power Standard for Gas, C. H. Stone.
The Luminous Arc, W. D'A. Ryan.

This list of papers should make a most attractive programme, covering a wide range of topics, and laying before the members the results of a large amount of original research. Still other papers are expected which will further add to the importance of the convention from the technical standpoint.

The late Mr. G. Dunbar Malam, who was for some years Engineer and Manager of the Bingley Gas-Works left £6868.

THE STORY OF THE GAS SUPPLY OF TOKIO.

From Information Supplied by Mr. Mizuta.

WELCOME of the heartiest character was given at the meeting of the Institution of Gas Engineers in Dublin to Mr. M. Mizuta, representing the gas profession of the Far East. He is one of the Engineers of the prosperous and progressive Tokio Gas Company; and on his arrival in this country, he offered to supply to the "JOURNAL" the material for a descriptive article. He has redeemed his promise; and it is with much pleasure that we are able to show, by narrative and photograph, how advanced, in the technical and administrative work of the gas industry, are our friends of Tokio.

Head Office of the Tokio Gas Company.

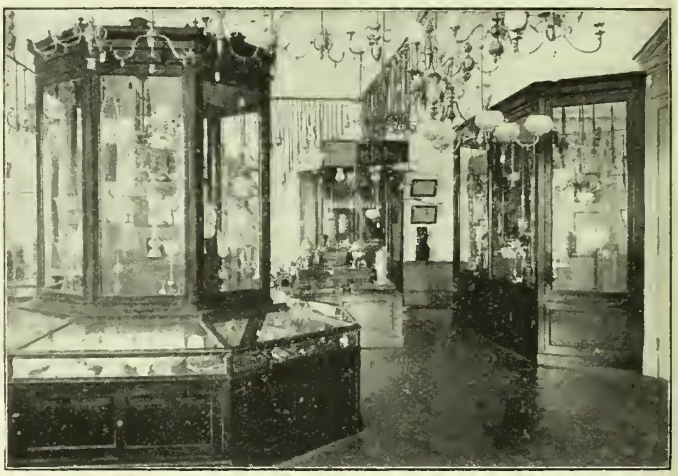
In Japan at the present time, there are only nine gas undertakings, in operation or in process of construction. These comprise the works at Tokio, Osaka, Yokohama, Kobe, Nagoya, Nagasaki, Fukuoka, Moji, and Sendai. Certain of these works are not in operation yet. Nagoya, for example, commences working this December; and the plans for Moji and Sendai are in course of development at the present time.

THE TOKIO GAS SUPPLY.

Regarding Tokio, the original gas-works, known as the Shiba station, were designed by the then Engineer, M. Pelegelain some 34 years ago; and gas was first supplied to the street-lamps on Dec. 18, 1874—the number of street-lamps at the time being only 85. The works were established by the Municipality; but the price of gas was then such that the undertaking did not flourish. It passed into the possession of the Company in 1885—the number of consumers then being 343; of burners connected, 6678; and of street-lamps 400. The length of mains laid was only 11 miles 62 chains. The demand for gas, however, was very small; being only about 71,000 cubic feet a day. The consideration paid by the Company for the works was 269,000 yen, or (say) £26,900.

A PROGRESSIVE BUSINESS.

In the 22 years that have elapsed since the transfer to the Company, the business has made substantial headway, under wise and judicious management. The capital is 8,400,000 yen, or equal to about £840,000; and the projected extensions of the works, it is calculated, will about double this capital. Both coal and carburetted water gas are made at the works; the production being in the second half of last year, 359,385,500 cubic feet of coal gas and 26,172,000 cubic feet of carburetted water gas. The increase in the consumption of gas in the half year was 17·2 per cent., compared with the corresponding period of 1905. The quantity of coal carbonized was 30,726 tons; and for the manufacture of water gas, 1,825,679 Japanese lbs. of coke were used (1 Japanese lb. = 1·323 English lbs.), and 86,624 English gallons of oil. The make of gas from 1 lb. of coal was 5·222 cubic feet; and of water gas from a ton of coke 32,110 cubic feet—the oil used for enrichment averaging 3·386 gallons per 1000 feet. Further evidence of the progressive character of the undertaking is furnished by the extent of the distribution system at the end of December last compared with its character when the Company took over the works. As stated above, there were only between 11 and 12 miles of mains laid in 1885; at December last, the length of mains was 166 miles 10 chains, and of services 289 miles 72 chains.



Modern Gas-Fittings Show-Rooms.

THE COAL AND OIL SUPPLY—RESTRICTED USE OF CARBURETTED WATER GAS.

A few words about the raw materials used in gas manufacture. Coal is chiefly obtained from the northern part of Japan—Yubari or New Yubaria being the best coal for the purpose. Many other sorts are also used for gas making; three descriptions, which come from the south, being Shiyogashira, Tagawa, and Miike. The price of coal varied from 12s. to £1 2s. per ton last year. The oil used in the manufacture of water gas is also obtained from the northern district of Japan; the oil having a specific gravity of ·903. The price paid for 1 koku of oil (1 koku = 4·96 bushels) is rather more than 10s. The cost of oil has been advancing of late years, and, in addition, the price of coke is not so low as in England; so that carburetted water gas cannot be made so cheaply as coal gas. Water gas is not used continuously. The Japanese Government has, in fact, restricted its employment to one-third of the output of gas. The illuminating power of the gas distributed is not regulated by the Government; but the

The Shiba Works—The Inclined Retort-House.

The Shiba Works—A Two-Lift Gasholder in Steel Tank.

Company supply a good illuminating quality—the carburetted water gas being 18-candle power and coal gas 16-candle power.

Administration and Executive Officers.

Before giving a sketch description of the plant in use at the works, Mr. Mizuta supplied the names of the gentlemen engaged in the administration of the Tokio Company's affairs, and of the Executive Officers. We reproduce them—

Chairman: Baron Shibusawa.

Managing-Directors: The Honourable Professor (Tokio University) T. Takamatsu; Mr. R. Kume.

Directors: Mr. S. Asano, Mr. S. Ohashi, Mr. F. Watanabe, Mr. K. Hakamada, Mr. K. Fukushima.

Auditors: Mr. S Watanabe, Mr. T. Kobayashi, Mr. K. Ito.

Chief Engineer: Mr. S. Hiramatsu.

Engineers—Shiba Works: Mr. A. Naito.
Sarue Works: Mr. T. Ueda.
Hashiba Works: Mr. M. Mizuta.
Bye-Products Works: Mr. N. Mori.
Fitting and Repairing Works: Mr. R. Sasabe.

Secretary: Mr. G. Hagiwara.

Up-to-Date Equipment.

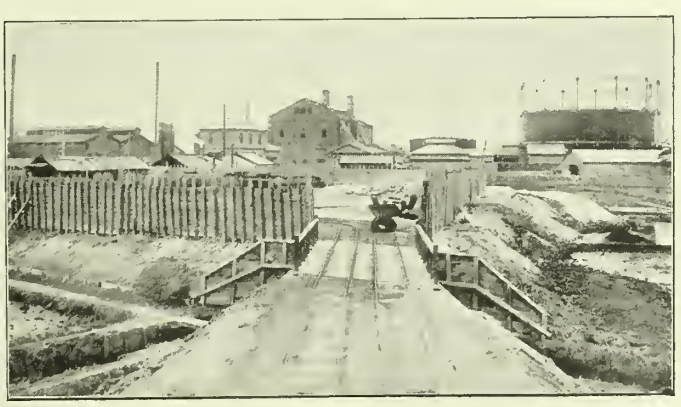
Shiba Works.—These works stand on the site of the works erected on the institution of gas supply in Tokio. Formerly they were equipped with small horizontal retorts; but these have given place to inclined retorts. At this station, the number of inclined retorts is 56, 20 feet long by 24 inches by 16 inches; each bed containing seven retorts. The settings are of the same design as those Mr. S. Y. Shoubridge constructed at the Salford Corporation Gas-Works. The equipment embraces coal-breaker, elevator, push-plate conveyor, and continuous hoppers. From the retort-house, the gas travels to water-cooled condensers of tubular form, designed on the works. There is nothing special to note about the exhausting plant, the "Standard" and Livesey washers, and water-sealed purifiers, except that oxide only is used in the latter. At these works there are two holders. The larger is of 660,000

The Hashiba Works—The Largest Building in Front is the Carburetted Water-Gas Plant House.
(Rice-Fields in the Foreground.)

cubic feet capacity, with two lifts and steel tank; this form of construction being necessary, as the nature of the ground (which is not so solid as in England) does not permit of brick or concrete tank work. The smaller holder is of 200,000 cubic feet capacity, two-lift, and with cast-iron tank. The station meter is of 40,000 cubic feet per hour capacity; and there are two governors—one 24-inch and the other 12-inch. The trunk mains to the city are 24 inches in diameter; and the gas leaves the works at ordinary pressures—2¼ inches in the day and 3 to 4 inches in the evening.

Hashiba Works.—These are the works of which Mr. Mizuta is the Engineer. The increasing demand for gas necessitated that the gas supply should be supplemented. The Hashiba works were the result; and their original construction was finished in November, 1893. The retort-house at that time was small; the equipment only consisting of 8 feet horizontal retorts. Here, too, things underwent a great change. There was no hesitation on the part of the Board and their Chief Engineer to spend to realize improvement in efficiency. Now the equipment comprises 74 horizontal retorts of 8 feet length, and 57 inclined ones of 20 feet length, by 24 in. by 16 in. Of the 57 inclines, 21 are in beds of sevens, the same as at the Shiba works; and the remaining 36 are in beds of nines. The ironwork was supplied by West's Gas Improvement Company, Limited; and the retorts were also sent from England, but the fire-bricks were made in Japan. The work was executed by Japanese handicraftsmen. The coal is put into store alongside the house, and each bench of settings—the three beds of sevens, and the four of nines—has its own coal-breaker, elevator, and hopper. Each hopper has a capacity of 12 tons. The charges are of 5 cwt.; but the duration of carbonization varies from six to seven and eight hours, according to the character of the coal being used. Japanese coal, Mr. Mizuta informs us, is not suitable for four-hour charges; and six or seven hours is a fair time for its carbonization. A water-gas plant is an important part of the equipment of these works. It has a capacity of a million cubic feet, in two sets, and was supplied by the Economical Gas Apparatus Construction Company, Limited. The plant is not always used; its service being required only for a short period in the autumn and winter.

After the coal gas leaves the retort-house, it passes through a Pelouze and Audouin tar-extractor, and then through an annular condenser of the air-cooled type. The Waller exhauster is driven by a gas-engine. There are six sets of tower scrubbers;



Another View of the Hashiba Works.

The Sarue Works—The Steel-Framed and Galvanized Iron Inclined Retort-House.

The Bye-Products Works at Fukagawa.

the gas passing through in three directions. Then a "Standard" washer and the purifiers deal with the gas; and, after being metered, it passes to a mixing chamber of special form, where it mixes with the carburetted water gas, when it is being made. The course of the water gas is from the generating plant to a condenser, thence to a scrubber, and onwards to the relief holder. From there to the water-gas purifiers, on to the meter, into the mixing chamber, thence (in admixture with the coal gas) to the gasholders. At this station, there are four gasholders—one of 1 million cubic feet capacity, and another of ½ million capacity. For both of these the material was supplied by the Whessoe Foundry Company; and the erection was carried out by the Company's own staff and workmen. There is also one of 120,000 cubic feet capacity, and one of 80,000 cubic feet. The smallest is the one now used as the water-gas relief holder. The trunk main from these works is of 24 inches diameter. There is a large amount of spare land at the works, set apart for future extensions.

On the Discharging-Floor of the Sarue Inclined Retort-House.

The Sarue Works.—These works are also modern; and the Company have arranged to make their carbonizing operations here somewhat extensive, seeing that the works are well situated on the river for the reception of the raw material, and the disposal of the secondary products. The works have at present an installation of 96 inclined retorts, the same size as those at the Shiba works, but arranged in two benches, each setting containing eight retorts. The retort-settings were designed by the Engineer, Mr. T. Ueda; the ironwork and retorts being supplied from England. The house in which this installation has been made, consists of a steel-framed structure, covered by galvanized iron. The remaining plant includes a Pelouze and Audouin tar-extractor, an air-cooled annular condenser, steam-driven exhauster tower scrubber, "Standard" washer, and purifiers on Green's luteless system. The first floor of the purifying-house is used for revivification. The gas is metered, and then passes to a holder of 600,000 cubic feet capacity, the material for which was supplied by Messrs. C. & W. Walker, Limited; the erection being carried out by the Company's own men. The ground is now being excavated for a new holder of 1½ million cubic feet capacity the contract for this having been secured by the Whessoe Foundry Company. This holder will be the largest in the Far East. The trunk main is 36 inches in diameter. There is such intercommunication between the three works, that the supply of gas

The Charging-Floor of the Sarue Inclined Retort-House.

to all parts of the city can be regulated according to the demand.

The Bye-Products Works.—The Company here make sulphate of ammonia; but the plant is only of 2 tons capacity at present. They are, however, going to extend it; there being an excellent

A View in the Fitting and Repairing Works at Fukagawa.

demand for sulphate in Japan. The Company also engage in the distillation of coal tar, and produce benzene, solvent naphtha, naphthalene, creosote oil, pitch, light oil, and carbolic acid. All these products are in good request in the country.

Financial Results.

We may give a few figures here from the accounts of the Company to show their remarkable financial progress.

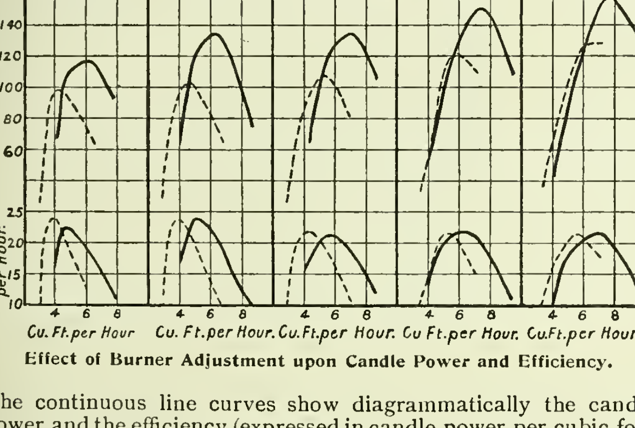
		Revenue.	Expenditure.	Gross Profit.	Total Dividend.	Dividend Per Cent.	Amount added to Reserve Fund.	Amount added to Special Purposes Reserve.
1906,	First Half	1,475,470 yen	988,311 yen	487,159 yen	420,000 yen	15	25,000 yen	21,016 yen 162
1905,	Second ,,	1,298,925 ,,	810,687 ,,	488,238 ,,	393,708 ,,	15	25,000 ,,	33,018 ,, 930
	First ,,	1,188,622 ,,	719,210 ,,	469,412 ,,	341,208 ,,	15	26,000 ,,	33,569 ,, 376
1904,	Second ,,	998,191 ,,	614,093 ,,	384,098 ,,	294,000 ,,	14	20,000 ,,	25,428 ,, 080
	First ,,	955,782 ,,	584,078 ,,	371,704 ,,	289,086 ,,	14	20,000 ,,	22,069 ,, 285
1903,	Second ,,	851,486 ,,	523,481 ,,	328,005 ,,	265,566 ,,	14	17,000 ,,	15,964 ,, 404
	First ,,	814,402 ,,	476,846 ,,	317,556 ,,	255,780 ,,	14	16,000 ,,	15,518 ,, 364
1902,	Second ,,	736,630 ,,	446,221 ,,	290,409 ,,	237,636 ,,	14	15,000 ,,	13,089 ,, 364
	First ,,	745,116 ,,	454,933 ,,	290,183 ,,	232,554 ,,	15	15,000 ,,	14,794 ,, 332
1901,	Second ,,	662,001 ,,	427,398 ,,	234,603 ,,	225,372 ,,	16	12,000 ,,	11,931 ,, 983
	First ,,	648,023 ,,	422,703 ,,	225,320 ,,	215,670 ,,	17	12,000 ,,	12,000 ,, 000
1900,	Second ,,	593,004 ,,	396,416 ,,	196,588 ,,	169,575 ,,	17	10,000 ,,	15,000 ,, 000
	First ,,	529,548 ,,	359,635 ,,	169,913 ,,	132,993 ,,	16	10,000 ,,	14,500 ,, 000

INFLUENCE OF CHIMNEYS UPON INCANDESCENT BURNER EFFICIENCY.

The variety of glass ware in use with ordinary incandescent gas-burners lends some interest to the investigations recently originated by the "Illumiuating Engineer" for the purpose of determining the influence of chimneys upon the efficiency and general lighting results achieved. Our contemporary disclaims any commercial or other interest in the work thus undertaken, save that of its readers and illumination practice generally; but it is not at all unlikely that some of the data obtained and thus supplied will be of considerable service to those engaged in the manufacture of incandescent burner chimneys.

For the purpose in view, five different forms of common clear glass chimneys were purchased in the open market. These consisted of two plain straight chimneys, one measuring $5\frac{7}{8}$ in. long by $1\frac{15}{16}$ in. and the other 8 in. by $1\frac{15}{16}$ in., and three air-hole chimneys, respectively $5\frac{1}{4}$ in. long by $2\frac{1}{4}$ in., $6\frac{3}{4}$ in. by $2\frac{3}{8}$ in., and $9\frac{7}{8}$ in. by $2\frac{7}{8}$ in.—the maximum diameter being given in each case. These were submitted to the New York Electrical Testing Laboratories for photometric testing with a Welsbach gallery burner equipped with deck plate and mantle. The first tests were confined to the measurement of the candle power (horizontal rays) with varying rates of consumption; the gas being taken from the street mains at a pressure of $1\frac{1}{2}$ inches.

The results thus obtained are dealt with by our contemporary in its first article on the subject. As, however, it was acknowledged that higher pressures than $1\frac{1}{2}$ inches might yield different results, it was decided to repeat the tests under other pressure conditions. We propose therefore dealing with the two sets together, and reproduce a diagram which includes the curves of both.



Effect of Burner Adjustment upon Candle Power and Efficiency.

The continuous line curves show diagrammatically the candle power and the efficiency (expressed in candle power per cubic foot per hour) of the burner when fittcd successively with the five chimneys and consuming gas at various rates under a pressure of 3 inches. The broken-line curves give the results at the $1\frac{1}{2}$ inches pressure already referred to.

The following tables show the maximum candle power and the maximum efficiency obtained with each chimney, aud the corresponding gas consumption and duty.

Chimney.		Maximum Candle Power. 1½ in. P.	3 in. P.	Consumption. (Cub. Ft. per Hour.) 1½ in. P.	3 in. P.	Efficiency. (C.P. per Cub. Ft. per Hour.) 1½ in. P.	3 in. P.
Maximum Candle-Power Basis.							
5⅞ in.	(a)	98	117	4·25	6·0	23·0	19·5
8 ,,	(a)	103	134	4·75	6·2	21·7	22·4
5¼ in.	(b)	107	134	5·45	7·0	19·6	19·2
6¾ ,,	(b)	121	150	5·95	7·5	20·3	20·0
9⅞ ,,	(b)	128	158	6·75	7·8	19·0	20·5
Maximum Efficiency Basis.							
5⅞ in.	(a)	96	106	4·0	4·7	24·0	22·4
8 ,,	(a)	92	121	3·9	5·0	23·7	24·0
5¼ in.	(b)	91	120	4·25	5·6	21·9	21·3
6¾ ,,	(b)	118	135	5·5	6·2	21·5	21·7
9⅞ ,,	(b)	117	151	5·5	7·0	21·3	21·6

(a) Straight. (b) Air-hole.

Commenting upon the above, the "Illuminating Engineer" remarks that the tests generally seem to establish the following points: First, that the highest efficiency is given by the short chimney with pressures under $1\frac{1}{2}$ inches, and by the 8-inch plain chimney with pressures from $1\frac{1}{2}$ to 4 inches; second, that the greatest candle power is obtained with the longest air-hole chimney; third, that a burner adjusted to yield its maximum candle power with any given chimney does not work at its highest efficiency, and *vice versâ;* and fourth, that increased pressure increases the candle power with all chimneys, but beyond a certain point decreases the efficiency.

It is obvious that the above data depend upon several factors, such as the burner, mantle, its age, quality of gas, and the like, which may well be termed variables; and the laboratory report is careful to state that their quantitative interpretation must be subject to the limitations imposed by single sets of conditions. The results, however, are so far concordant that they may perhaps be accepted as generally warranting the couclusions of the "Illuminating Engineer." It is useful to note that with the longer plain chimney, and still more with the air-hole chimneys, the greater amount of total light is only obtained with a higher consumption of gas—a fact which seems to suggest that where consumers have found increased light resulting from the adoption of perforated glass chimneys, these have been simply acting as correctives by affording additional air to some excess gas.

Our coutemporary draws attention to the indication given by the curves that the highest efficiency of an incandescent gas-burner is not obtained under the conditions at which it gives its maximum quantity of light. The only combination of burner and glass ware where they nearly accord is, however, that of the $5\frac{7}{8}$-inch plaiu chimney; and experimental error might well account for the fact that they do not. In the other cases, it must be agreed with the "Illuminating Engineer" that the consumer's practice, of adjusting a burner to obtain the maximum light, invariably causes it to operate considerably below its maximum efficiency. Unfortunately, a consumer has no ready means of knowing when he attains the greatest duty from his burner.

A further set of tests, with the same burner and chimneys, was made to ascertain the effect of varied gas pressure with a fixed burner adjustment. The curve diagram shows in each case an increasing total candle power as the pressure is raised up to $4\frac{1}{2}$ inches, but with a progressive rise in the gas consumption. The efficiencies, however, of the several combinations (excepting in the one case of the $9\frac{7}{8}$-inch air-hole chimney) dropped soon after $1\frac{1}{4}$ to 2 inches pressure was passed. The following table gives the salient figures:—

Chimney.		Pressure. (Inches Water.)	Maximum Candle Power.	Efficiency. (C.P. per Cub. Ft. per Hour.)	Consumption. Cub. Ft. per Hour.
Maximum Candle Power Basis.					
5⅞ in.	(a)	4½	136	17·1	8·0
8 ,,	(a)	4½	154	20·7	7·3
5¼ ,,	(b)	4½	154	20·7	7·3
6¾ ,,	(b)	4	162	18·3	8·9
9⅞ ,,	(b)	4½	180	19·6	9·2
Maximum Efficiency Basis.					
5⅞ in.	(a)	1¼	95	22·4	4·0
8 ,,	(a)	2	123	25·1	5·0
5¼ ,,	(b)	1½ to 2	90 to 104	21·2	4 3 to 4·9
6¾ ,,	(b)	1¼	105	21·3	4·9
9⅞ ,,	(b)	3·2 to 4·2	153 to 175	19·7	7·9 to 8·9

(a) Straight. (b) Air-hole.

In speaking of the air-hole chimney, our contemporary had previously remarked that it would probably come as a surprise to many that this, which was accepted from Germany as a great improvement, was, as a matter of fact, inferior in efficiency to the plain, straight chimney. In a later article, the subject is again referred to for the purpose of further inquiry. The tests in this case were made with the view of determining whether the characteristic performance of the burner equipped with the perforated chimney was due to the effect of the air-holes or to the peculiar shape of this class of ware. The two $6\frac{3}{4}$-inch and $9\frac{7}{8}$-inch air-hole chimneys (with, however, the holes closed by mica strips) were chosen for investigation; and at the same time a mica chimney, 7 in. by 2 in., was subjected to test—first plain, then perforated. The gas was taken from the New York City mains under a pressure of $1\frac{1}{2}$ inches, as in the case of the first set of tests. Curves of the results contrasted with previous data are given; and from these the following information is gleaned:—

Chimney.	Maximum Candle Power. Candle Power.	Cubic Feet Per Hour.	Candle Power per Cubic Foot per Hour.	Maximum Efficiency. Candle Power per Cubic Foot.	Rate of Gas Consumption.
					Cub. Ft.
6¾ in. by 2⅜ in. diameter. Air-holes closed and deck-plate removed .	77	4·4	17·5	19·9	3·45
Ditto. Air-holes opened	121	5·95	20·3	21·5	5·5
9⅞ in. by 2⅞ in. Air-holes closed	70	4·36	16·0	16·5	3·95
Ditto. Air-holes opened	128	6·75	19·0	21·3	5·5
7 in. by 2 in. Mica plain, without deck-plate .	109	4·9	22·2	22·3	4·75
Ditto. Perforated and with deck-plate . .	133	5·7	23·3	23·4	5·70

From these later tests the "Illuminating Engincer" states its conclusions to be that the long air-hole chimneys give the highest total candle power; that air-holes increase the efficiency obtainable with chimneys of more than 2 inches diameter; but that the highest efficiency (as previously deduced) is obtained by the use of small plain chimneys. It would scem strange that, while all the tests prove that straight unperforated chimneys yield

the greatest duty in candles per cubic foot, this last set of experiments is so far contradictory, in that it indicates a greater efficiency with air-hole chimneys compared with the same chimneys with the holes closed. The reduction in efficiency in the latter case may, however, be merely apparent, and due either to the shape and size of the glass as compared with a small plain one, or possibly to slight obscuration of light rays by the mica strips. In any case it is to be seen that the greater duty with perforations is only obtained with a much larger gas consumption, for which many burners are not adjusted, and is therefore beyond attainment by the ordinary consumer.

A NEW RECORDING GAS CALORIMETER.

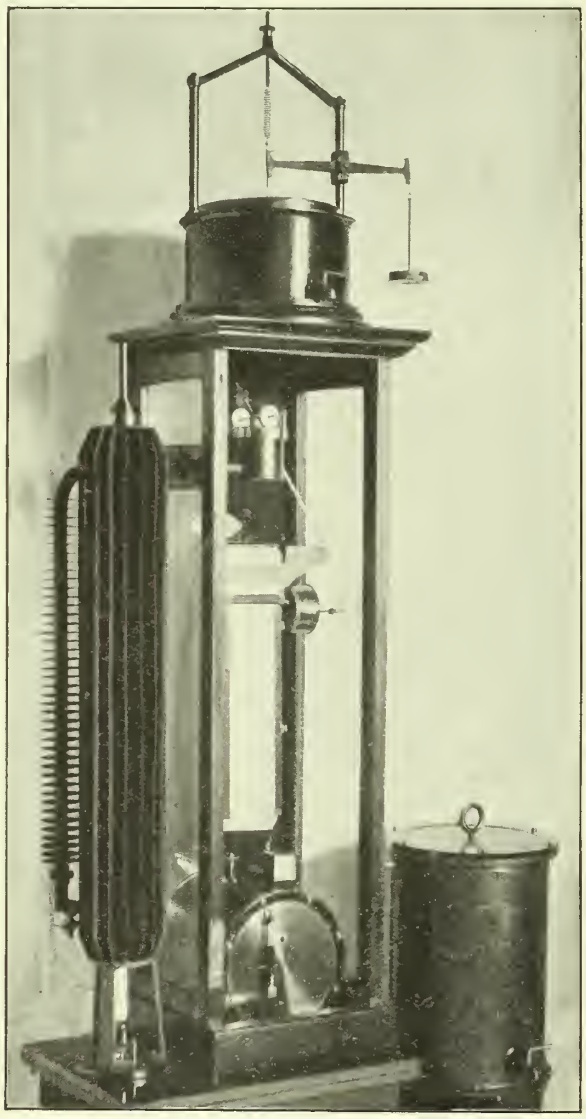


Fig. 1.—The Beasley Calorimeter.

The changed conditions in the production and use of gas for illuminating, heating, and power purposes which have come about during the past few years have caused attention to be directed to the methods employed for testing its quality. In the department of lighting, the introduction of the incandescent mantle has necessitated, as our readers are aware, the adoption of another standard than that of candle power for testing the gas employed with it; while for cooking-stoves, heating appliances, and gas-engines, it is obviously of greater importance to have gas of a definite heating value than to have it of a particular light-giving power. It is consequently within the bounds of probability—indeed, there is marked evidence of it in existence—that in the not-distant future gas will have to be supplied of a standard calorific value. This fact has led to the production of an instrument—the calorimeter—which will indicate this value clearly and accurately, and at the same time automatically. The calorimeters now in use are constructed mostly on the absorption principle—the heat developed by the burning gas being absorbed by water contained in a jacket surrounding the flame. If the quantity of gas burnt and the amount and temperature of the water used are known, the calorific value of the gas may be ascertained by calculation. Calorimeters working on this principle give a thermal value of the fuel tested which is not comparable with actual results in practice—being, in the case of some gases, considerably too high. For the new instrument about to be described, however (which is constructed by Messrs. C. H. & F. G. Beasley, of Smethwick), no

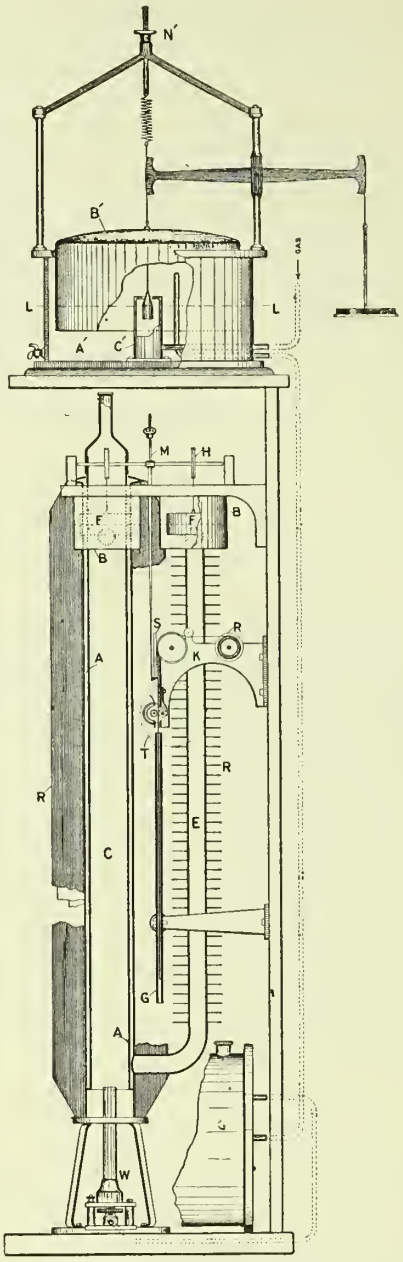


Fig. 2.—Section of Calorimeter.

water supply is required, and there is nothing of a complicated nature in its mechanism, nor are there any delicate parts liable to give trouble in the hands of unskilled people. The advantages of such a calorimeter should appeal to all who require continual gas testing, and are desirous of saving the expense of analyses. It is entirely automatic in action and self-contained; and it gives, it is said, clear permanent records of the calorific values of the gases tested.

The main idea of Messrs. Beasley has been to design a calorimeter of which the indications should be a valuable guide to an engineer by not representing the total number of heat units actually generated by the burning (in air) of a unit weight or volume of a gas, but only the number available for practical purposes. When a gas containing free or combined hydrogen burns, water is formed; and if this escapes from a gas-engine or any other appliance in the state of vapour, a considerable percentage of the total heat of combustion of the gas is lost. It is apparent, therefore, that of two gases having the same total heats of combustion, the richer, from a practical standpoint, is the one containing the least hydrogen. A gas composed of equal quantities of hydrogen and carbonic oxide has a high-value calorific power of 344, and a low-value one of 319. But supposing the composition of the gas to chauge to 75 per cent. of hydrogen and 25 per cent. of carbonic oxide, the high and low values would alter respectively to 344 and 307. A calorimeter recording high powers would indicate practically no change in the quality of the gas, notwithstanding the fact that the general behaviour of gas appliances and the outputs of gas-engines would fall off considerably. While these may be somewhat extravagant examples, they nevertheless serve the purpose of demonstrating the importance of having an instrument which records the low and not the high values for the calorific powers of gases. In water-cooled calorimeters, the products are brought down to the temperature of the air by a stream of water; the rise in temperature of the water being a measure of the calorific power of the gas. In the Beasley calorimeter, the gas is burned in a good supply of air in a well-radiated chimney, the average temperature rise of which is directly proportional to the heat developed by the flame. And since the products of

combustion leave the instrument at about 70° C., no water is condensed; and by virtue of this the calorimeter gives only the low-value powers.

The new calorimeter is shown in the accompanyiug illustrations; fig. 1 being a perspective view and fig. 2 a sectional diagram. A U-shaped vessel, oue limb of which is formed by the annular space A, between the concentric walls of a vertical chimney C, is provided at the top of each limb with a small tank B, and contains enough oil to fill the tube A (which is a jacket surrounding the chimney) and the cold limb E, and also to partly fill the two tanks B. The gas to be examined is burned at an atmospheric burner W at the bottom of the chimney, and the oil in the heated limb A rises to a level above that in the cold limb correspouding to the increased temperature. The difference of level is therefore a measure of the calorific value of the gas, and is recorded automatically by means of two floats F, situated iu the tanks B, and connected by threads to two pulley-wheels arranged upon a horizontal spindle H. This spindle rotates as the floats rise and fall respectively, aud operates a lever M carrying a marker. The latter traces a diagram upon the moving band of paper actuated by the clockwork T, and ruled with a scale which indicates the low calorific values. The paper gear is shown built upon the bracket K. The supply for a week's run is wound on a wooden spool and is transferred for use to the roller P. By means of the clockwork the paper is drawn over rollers passing the back of the scale S in contact with the marking-pen M to the long paper guide G, which is sufficiently long to always allow the exhibition of a 24 hours' record.

To secure the constant stream of gas to the calorimeter, it has been necessary to use a pressure regulator and a stream controller, for which a patent has been applied for. The pressure regulator (shown above the calorimeter) is of the ordinary type; but the dimensions and weights of the different parts have been carefully studied, so as to meet present requirements. The outer vessel A^1 is filled with oil to the level L, and forms a lute to the bell B^1, from the centre of which is suspended by a light chain a somewhat heavy cone. For normal gas pressures, the bell is counterpoised by a spring and balance-weight D. Au increase or decrease in the pressure raises or lowers the bell, restricting or opening the gas passage between the suspended cone and a feather-edged seatiug in the chamber C^1. The bell, being large, is very sensitive to small changes of pressure, and the regulator will maintain in the bell a constant pressure of 5-10ths of an inch of water, which is the pressure necessary to work the controller, and this against pressure variations from 1 inch to 10 inches in the main gas supply. This form of regulator has been tested and found to behave perfectly, even when the cone and seating are almost covered with tarry matter from producer gas.

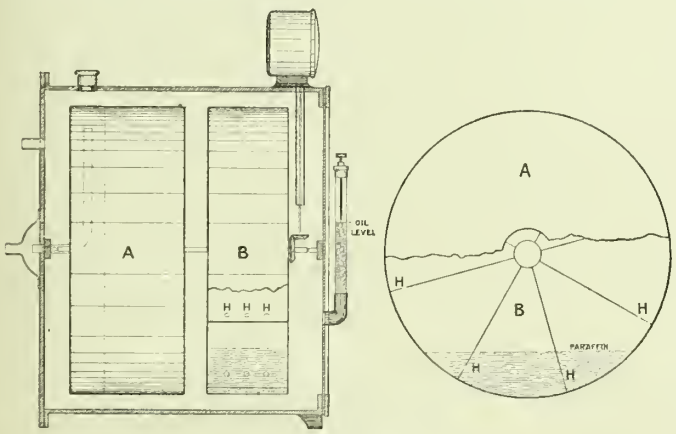


Fig. 3—Gas Controller.

The flow of gas through a pipe or orifice depends directly upon the square root of the actuating pressure and the area of the orifice. To obtain a constant stream of gas, therefore, it is not only essential to have a constant gas pressure, but also a constant resistance to the flow of gas. The constancy of the resistance offered to a stream of gas by the jet of an ordinary burner cannot be depended upon, particularly in cases where the gases are not clean; and on this account it has been necessary to design a special form of controlling apparatus, shown in fig. 3, which regulates the flow of gas independently of the burner-jet. The principle of this controlling apparatus is the regulation of the delivery of the gas by maintaining a constant speed for the drum of a gas-meter.

The meter drum A is directly coupled to the controlling drum B, which is divided into six or more compartments, and contains a definite quantity of rectified paraffin. The flowing of the paraffin from compartment to compartment through the small holes H constitutes a definite brake to the rotation of the drum system; and, actuated by pressure maintained constant by the pressure regulator, the meter-drum is turned at a constaut speed and delivers a uniform stream of gas.

Since the magnitude of the gas stream is independent of the size of the burner-jet, the latter is made unusually large, and much tarry matter may deposit itself in the jet without in the least affecting the constancy of the gas stream. The atmospheric burner

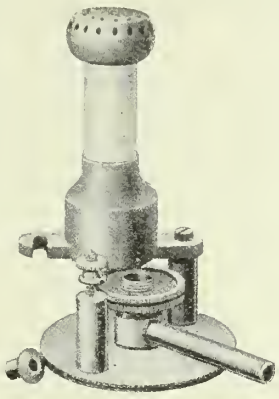


Fig. 4—Atmospheric Burner.

used in connection with the calorimeter is shown in fig. 4. The air inlet is easily adjusted by the large milled screw; and a special feature of the burner is its construction for readily allowing the removal of a dirty gas-jet and its replacement by a spare clean one. The steatite rosehead shown in the illustration has been dispensed with in the latest type of burner.

Considerable attention has been given to the testing of the Beasley calorimeter; and the patentees claim that it is accurate, very sensitive, and thoroughly reliable. A test was carried out in which commercial hydrogen from a cylinder was burnt under the calorimeter. By analysis, the gas was found to have a low-value calorific power identical with that given by the calorimeter—viz., 274 B.Th.U. per cubic foot. The hydrogen was diluted with different volumes of nitrogen; and the following tabulated results show the degree of sensitiveness of the instrument:—

Stream of Gas in Cubic Feet Per Hour.	Percentage Composition of the Mixed Gases.		Calorific Values.	
	Commercial Hydrogen.	Nitrogen.	Deduced from Composition.	Recorded by Calorimeter.
5·18	100·00	..	274 B.Th.U.	274 B.Th.U.
5·18	98·99	1·01	271 ,,	271 ,,
5·18	97·30	2·70	267 ,,	266 ,,
5·18	91·99	8·01	252 ,,	252 ,,
5·18	86·00	14·00	236 ,,	237 ,,

The calorimeter has also been tested and found to be very insensitive to normal changes—(*a*) in the temperature and humidity of the atmosphere, (*b*) in the condition of the radiators, and (*c*) to the state of the inside of the chimney. In one test made, the steady records of the calorific value of a homogenous gas were not affected by as much as 1 per cent. by the settling of large quantities of dust on the radiators; nor were they in a second case by the abnormal coatiug of the inside of the chimney with soot from the burning of machiue oil.

The gases used for standardizing the instrument are hydrogen and carbonic oxide—the latter gas being very convenient, as it can be prepared in a very pure state by decomposing formic acid with sulphuric acid. The gas is generated (in large flasks), washed with water and caustic soda, and then stored in a large gasholder. It is tested in the Hempel apparatus for carbonic acid (which should be absent), aud also for oxygen, &c. But for the more particular estimation of the total carbonic oxide present in what should be practically pure gas, an apparatus has been specially designed, which gives very uniform results, as shown by the following analyses of two samples: No. 1, total CO = 98 per cent.; No. 2, total CO = 97·97 per cent. The calibration of the instrument is also checked by the use of pure hydrogen.

The calorimeter described is finished in polished slate and mahogany, stands about 7 feet high, occupies a floor space of approximately 3 square feet, and weighs about 2 cwt.

The prospectus has been issued for the Franco-British Exhibition of Science, Arts, and Industries, to be held at Shepherd's Bush next year. In the list of the Groups and Chairmen are the following: Constructional Engineering, Sir Alexander Binnie, Past-President of the Institution of Civil Engineers; Electrical Engineering, Dr. R. T. Glazebrook, F.R.S., Presideut of the Institute of Electrical Engineers; and Gas Engineering, Mr. H. E. Jones, M.Inst.C.E., Past-President of the Institution of Gas Engineers.

We learn from the "Engineer" that a pumping-engine of exceptional size has recently been ordered for the city of Nashville (Tenn.). It will have a daily nominal capacity of 20 million gallons of water, against a head of 390 feet, and will be operated by steam at a pressure of 160 lbs. per square inch. The plunger speed is 240 feet per minute at 20 revolutions of the engine; the stroke being 6 feet. The duty guaranteed is 175 million foot-pounds per 1000 lbs. of dry steam consumed by the engine and all its auxiliaries. The total horse power will be about 1550.

An unusual pumping plant forms part of the water-works of Casino, New South Wales. A well 10 feet in diameter and 55 feet deep was sunk 200 feet from a river, from which the supply is drawn through a 12-inch iron pipe, its intake end being supported on a timber staging and fitted with a movable arm and screen. The water is delivered by a four-stage centrifugal pump in the bottom of the well, provided with a vertical shaft driven by a 30 H.P. steam-engine. The water is discharged into a concrete reservoir, 139 feet above the pump and 3700 feet from it, through a 6-inch main, so that the total head against which the pump works is quite high for a capacity of only 250,000 gallons daily.

A FRENCH ENGINEER'S INSTRUCTIONS FOR THE MANAGEMENT OF REGENERATIVE FURNACES.

At a time when more attention than ever is being given to methods of carbonizing, and when the gas engineer and manager is endeavouring to extract the utmost from the working of his retort-settings—of whatever type they may be—it is often of profit and interest to see and record what are the views and practices of engineers abroad. This it is which frequently makes a visit to Continental gas-works so beneficial—not perhaps in directly supplying the visiting engineer, or deputation, with any definite apparatus or method to be adopted, but rather in the prompting of some view or idea originating from the conditions and aims of others.

Particularly may this prove to be the case in regard to retort-house working; for though the extraction of the greatest serviceable amount of gas from a given quantity of coal may be the object of gas-makers all the world over, yet there are innumerable ways and means by which this one object can be achieved. Even when identically the same type or system of furnace and retort-setting is adopted, it will be found that there are many divergencies in practice and procedure between one installation and another. Times and methods of charging and discharging, of scurfing retorts, of cleaning ascension pipes, of regulating the seal of dip-pipes, of manipulating the hydraulic main tar and liquor, of controlling the chimney draught, of managing dampers, of firing the furnace, of conducting the clinkering—all these, and a host of other points, may vary considerably in different works having the same plant and the same object in view. Comparisons, in such cases, are not odious, but proper and beneficial.

Where the comparison is instituted, not between the works of one town and another, but between the practice of one country and another, then the technical relation is not so close; and therefore the result of the comparison is frequently more striking and sometimes more suggestive. Distillation and purification are the two departments of gas manufacture which, being the most important, offer the greatest scope for varying views and diverging practices. In purification, the objects striven after are not always the same, and the materials used may be different. In carbonization, the aim is practically constant, and the appliances used only vary in degree. What variation there is between the carbonizing methods of gas engineers of different countries probably arises from the differences of value in the raw material, coal and its residual, coke.

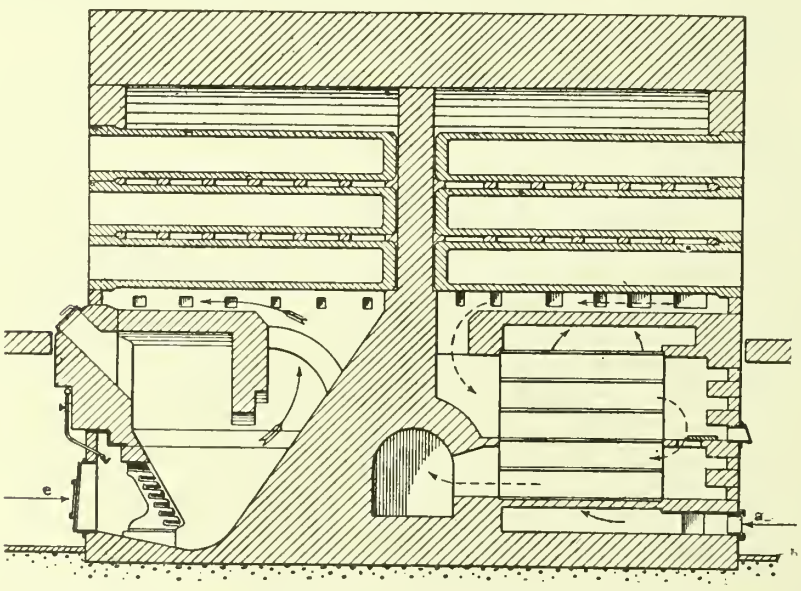
In Great Britain, both these commodities are too plentiful for the extreme of scientific and economical treatment to have full play; but in France and Italy, for instance, it is not so. Therefore more exhaustive arrangements may be adopted to extract the fullest benefit from the more expensive materials operated upon. This, in the opinion of some, leads, in retort-house practice abroad, to more complicated and more costly furnaces, to higher temperatures for carbonization, to less fuel expenditure, and to greater care with the coke. Be this as it may, the investigation of points such as these can only be a fruitful source of research.

For analogous reasons to these, the examination of foreign methods of management of retort-beds, as compared with our own, may be useful; and we therefore welcome the views of a well-known French engineer and builder, M. Derval, of Paris, upon the subject. Trained in the Ecole Centrale, and ever since practising solely as a furnace specialist, not limiting himself by any means to gas-works' ovens, but designing and erecting furnaces for glass-works, metallurgical purposes, pottery and porcelain, &c., M. Derval, as the successor to the earlier French furnace designers, MM. Gaillard, Haillot, and Radot, has achieved considerable reputation, and is rightly regarded as a leading expert, both on the theory and practice of industrial heating. What he says, therefore, on the subject of regenerative furnaces is worthy of every consideration; and as he has recently put into pamphlet form some practical "Instructions for the Drying, Lighting Up, and Management of Regenerative Furnaces," we give a translation of them for the benefit of English retort-house workers. We do so the more readily because the only English parallel to it with which we are acquainted is contained in a small book written by Mr. Maurice Graham, under the title of "Practical Hints on the Construction and Working of Regenerative Furnaces;" and this has long been out of print. M. Derval's practical advice may therefore prove of considerable use, more especially to those directly concerned in the management and daily working of gas-works' retorts, and who may not have occasion to fathom the mysteries of regeneration.

The pamphlet referred to undoubtedly fills a gap in French gas literature, and we believe it will not be without its utility in an English form. It may be added that though the instructions given are illustrated by M. Derval's own designs of furnace, they are also generally applicable to all regenerative retort-beds. Four types of furnaces are dealt with. There is first the simple regenerative or recuperative furnace, based on the ordinary principle of regeneration; the fire-bars being stepped down in ledges. An extension of this simple regenerative system is that with double combustion, in which a second or double supply of secondary air is introduced at a given point in the setting, so as to ensure the complete combustion of the producer gases. This arrangement is particularly adopted for through retort-beds with only one producer, and for inclined and vertical retorts. The third type is known as double regeneration; the primary air in this case being heated before it is led under the horizontal fire-bars of the furnace. Lastly, there is a special form of producer adopted with hinged grate-bars arranged for burning coke dust mixed with 30 or 40 per cent. of fine caking coal. We will now give M. Derval's instructions for managing these different types of furnaces and settings.

Drying the Beds before Placing the Retorts.

This drying is not indispensable; but as it allows of ultimately expediting the working of the retorts, and as it protects them from certain movements of the brickwork which might lead to their cracking, if all the necessary precautions were not taken at the moment of lighting up, it is not a bad thing to have done when circumstances allow of it. The brickwork of the producers and the regenerators being finished, and the retort supports and nostril-pieces being in place, the retort-arches are closed by a wall 11 centimetres (say, 4½ inches) thick, of red brick. All the dampers and sight-holes, with the exception of the main flue dampers, are shut; so that the chimney draught can only affect the fire-bars of the producer, the door of which must be left half open. Then a small wood fire is laid on the fire-bars (or on part of them); and this is gradually added to during the first two days. When the draught has thoroughly caught hold, and the brickwork has begun to heat, coke is added to the fire, and the heating up is continued with this fuel. At this moment, also, the secondary-air dampers should be slightly opened, so as



e, primary air. *a*, secondary air.

Note.—The feathered arrows indicate the course followed by the gas. The unfeathered arrows indicate the course followed by the secondary air. The dotted arrows show the waste gases.

Fig. 1.—Section through Centre of Producer and through Centre of Regenerator.

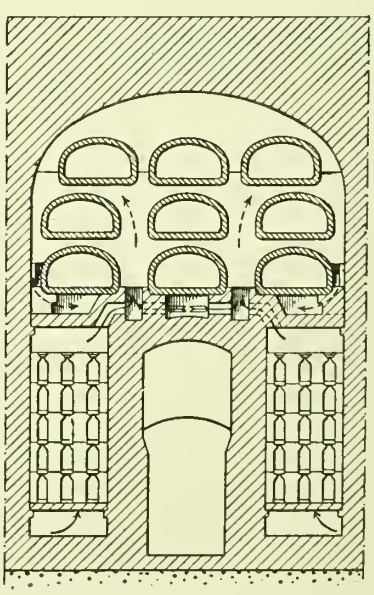


Fig. 2.—Cross Section.

to carry off the steam which is formed in the ducts for the circulation of the air. The draught is then gradually increased, and consequently the intensity of the fire, until the drying is finished —that is, until the outside walls of the structure are just warm, and no more smoke is seen to issue from any of the joints of the brickwork.

This operation lasts for about a week and requires constant supervision, especially at night when there is a tendency for the stokers to overcharge the fire-bars so as to have a longer interval of rest. Such variations in the heat of the furnace have a very bad effect on the brickwork; and it is necessary to see that the fires are fed often, and in small quantities—a certain space always being left between the fuel and the nose of the producer. If the bench being dried is worked by a new chimney, it may be necessary, at the beginning of the drying, to start the draught by a small fire in the base of the chimney. When the drying is completed, all the dampers and openings of the bed must be shut, so that the brickwork can cool gradually. Taking down the mask or temporary walls can then be proceeded with.

Drying the Beds before Starting to Work.

In order to dry beds which have been newly built, or in which new retorts have been mounted, it is necessary:

1.—To open all the dampers, except those for the inlet of the secondary air in the bottom of the regenerators—that is, dampers *a* shown on fig 1. Where the furnace doors are provided with fan slide, or ventilator, and openings, these should be fully opened, so that the primary air can enter freely under the fire-bars.

2.—To make a coke fire on the horizontal grate, or on the false or spear bars (fig. 3) if the producer has a stepped grate. The intensity of the heat should be increased little by little, so that the brickwork may be heated as slowly as possible. This is especially necessary when the retort-beds are entirely new.

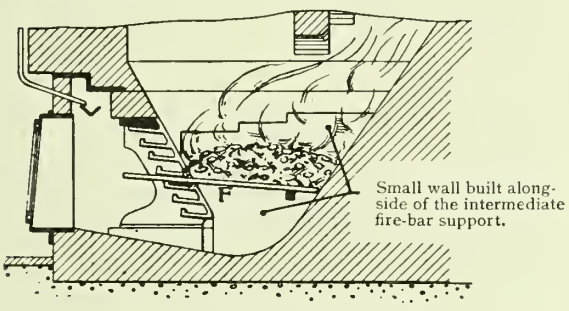


Fig. 3.—Simple Regenerative Furnace.

At the commencement of the operation—that is, during the first two or three days (if time be not pressing)—the waste-gas dampers should be opened very slightly. The sight-hole plugs at the top of the façade of the bench should also be opened to allow the greater part of the steam to get away without passing through the regenerators, where it might partially condense if the weather was very cold. But more often it is the practice to open the waste-gas dampers wide enough for the mixture of air, gas, and steam to have a sufficient volume, so that there will be no condensation in the passages of the regenerators. In either case, the opening of the sight-holes in front of the bench does not cause any inconvenience during the beginning of the drying; but it is, of course, necessary to close these holes when the temperature has to be raised.

The furnace-bars ought not to have more than 40 to 50 centimetres (16 to 20 inches) thickness of coke upon them, because above this depth, there is risk of gas firing. To avoid making carbonic oxide gas, it is advisable to allow a certain space between the fuel placed on the grate and the nose of the producer, so that there may always be a certain amount of air in excess.

Towards the end of the drying, when the fuel bed begins to get rather thick and the producers are quite red, the feeding doors of the producers can be left half open, so that the air can burn any carbonic oxide gas which may be formed. The false grate F (fig. 3) has for its object the protection of the metal parts of the stepped grate by carrying the fire towards the bottom of the producer; but it obviously is of no use if there is a horizontal grate, as in furnaces for burning coke dust, or in those having double regeneration (see figs. 5 and 6). When the producers are very wide, and have one or more intermediate supports for the fire-bars, it is generally preferable to reduce the grate surface by building small walls by the intermediate supports and stopping up the spaces between the stepped grate-bars with bricks and grouting. Where there is a horizontal grate, or where false fire-bars are used, it will suffice to place a few bricks on the flat on the bars, and throw a layer of cinders and clinker on to that part of the grate which is not required to be used.

During the whole of the drying, the ventilator openings in the furnace doors ought to be full open. The movements in the brickwork must be watched, and the buckstays and tie-rods, &c., must be loosened in accordance with the usual practice. Where there are no springs, it is well to place between the buckstays and the plates of the tie-rods small wooden boards or lead plates, which can be crushed under the expansion of the brickwork. When the whole bench has been newly built, the drying period ought to last eight to ten days; and it is always advisable to increase this period in order to avoid the brickwork expanding in an abnormal manner through over-forcing the fires. If the beds have already been in fire, the period of drying and gradual heating up again can be reduced to about half—viz., 4 or 5 days. At the end of this time, if the drying has been properly done, the working part of the oven will be found to be a dull red, and a start in gas firing can be made under good conditions.

Two or three days before commencing gas firing—that is to say, when the temperature of the bed has begun to rise—a half charge of coal should be put into the retorts, 90 or 100 kilos. (about 2 cwt.), and the caps of the ascension pipes should be opened, so that the gas produced can escape freely. Towards the end of the drying, the whole of the width of the grate is generally utilized by demolishing the small walls built behind the intermediate supports, or by taking out the bricks placed temporarily between the bars of the stepped grate.

Commencement of Gaseous Firing.

The coke fire on the grate being quite brisk and the nostril pieces being brought to red (which ought always to be endeavoured to be reached without using wooden laths or a gas-flame, as explained later), it is necessary: (1) To take away the bars of the false grate (when there is one) and to allow the incandescent coke to fall on to the bottom of the producer. Take away the clinker. Fix the real bars on their cast-iron supports. Allow the coke to light itself, and gradually charge the producer until the nose of it is covered by about 10 to 15 centimetres (4 to 6 inches) of coke. While firing up, leave partly open the charging door of the producer; taking care, however, to regulate the main flue dampers in such a way that the draught will be strong enough to prevent the flames coming out of the charging door, which might heat it and misshape it. After letting the fire fall on to the bottom of the producer, it is well to allow a little water to run into the basin of the producer. In this way, direct firing—that is, without the production of carbonic acid—is continued until the nostrils are really brought up to red. The actual gaseous firing is then proceeded with in the following way: (1) The fan openings in the furnace-doors are, of course, to be wide opened, so that primary air can always have free access to the grate. (2) Half-open (that is, from 7 to 8 centimetres, about 3 inches) the two secondary-air slides (*a* fig. 1) the two main flue dampers still being opened as they were during the previous heating of the bed. (3) Gradually charge the producer—say, with 3½ qrs. of coke at a time—until carbonic oxide gas is seen to burn above the nostril holes. Put in the successive charges of coke when the preceding charge is well alight; but when once the gas is ignited, the producer can be completely filled up to the charging door. When the nostrils are very hot, and there is no doubt about the gas igniting on arriving at the nostril holes, the producer can at once be fully charged with dry coke after having opened the secondary-air slides. On the other hand, when the temperature at the nostrils is doubtful, it is better, after having opened the secondary-air slides, to burn large wooden laths above the line of nostril holes. These generally catch light on coming in contact with the hot air, and ought to be sufficient in number to keep up the combustion during a quarter-of-an-hour. Immediately after the introduction of the first laths, charge the producer fully and as quickly as possible with dry coke, taking care to keep going the wood flame above the nostrils until the gas is seen to ignite freely, which generally happens after a few minutes. (4) When the gas is well alight and the retorts near the nostrils begin to get red, it is necessary to diminish the

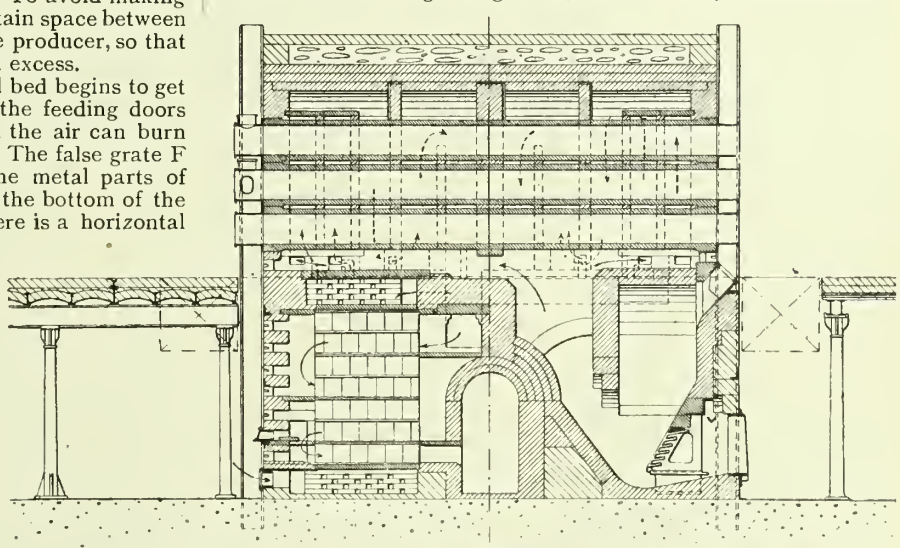


Fig. 4.—Simple Regenerative Furnace, with Double Combustion of Gas. Section through the Centre of a Double Bed of Nine Retorts.

intensity of the heat by reducing to ouly 2 or 3 centimetres (about 1 inch) the opening of the main-flue dampers. The secondary-air dampers can be kept as they were at the moment of gas firing. If there is an excess of gas in the bed, it can be got rid of by suitably closing the primary-air dampers, or else the ventilator openings in the furnace doors.

In principle, the starting of gas firing of retort furnaces ought always to be done with a large excess of air at the nostrils—at all events, during the first few hours. It is esseutial to watch carefully that the temperature of the bed does not rise too rapidly, which can be easily prevented by judicious manipulation of the different dampers, especially those for the main flue. A too sharp rise of temperature would lead to cracking of the retorts and to displacement in the brickwork.

The drying and starting in operation of furuaces with double combustion (fig. 4) are carried out in the same way—that is, without considering the working of the secondary-air dampers intended to complete the combustion of the gas. This operation is carried out later when the retorts begin to carbonize coal.

The same applies to furnaces with double regeneration (fig. 5), the drying and gaseous firing of which are effected while the furnace doors are partly open. The regulating of the slides for the primary air (which, in ordinary working, has to be previously heated in the base of the regenerators), is only done after the furnaces have worked for a day or two as simple regenerators—that is, with the introduction of cold air under the fire-bars.

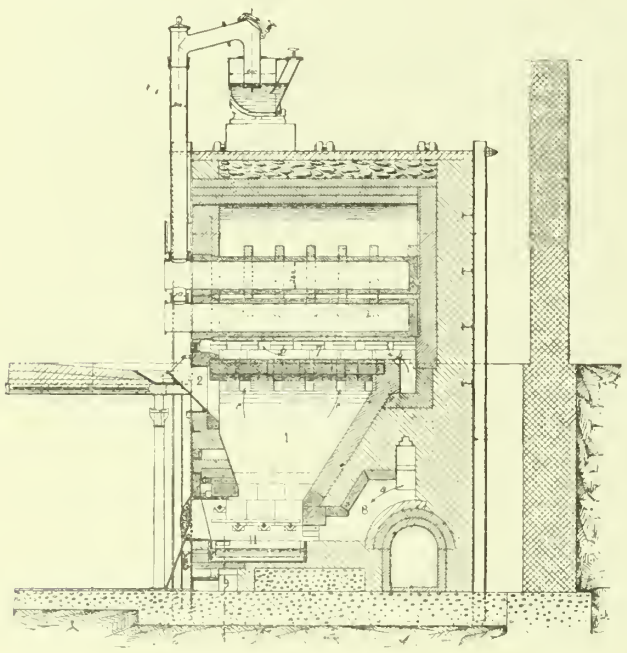


Fig. 5.—Double Regenerative Furnace. Section through the Centre of the Producer.

Regulating the Furnace.

When gas is being produced iu sufficient amount and the interior of the oven begins to get red, a commencement can be made with the regulation of the intensity of the heat by shutting the furnace door (which has up to now been open) and by gradually reducing the opening of the secondary-air slides. The quantity of secondary air arriving at the nostrils should always be sufficient to burn off completely the gas produced. Whether there is an excess of gas cau be found out by opening one of the sight-holes placed in front of the bench. If the bed is under pressure (as it ought to be), the gas comes out and lights itself, burning with the blue colour characteristic of carbonic oxide. When the bed is quite hot, the best method of ascertaining the presence of an excess of gas is by opening one of the sight-holes placed in the bottom part of the regenerators.

Yet another method, and a very practical one, of seeing if there is an excess of gas, and of finding out whether the bed is under pressure or in vacuum, consists in inserting in the bed through one of the sight-holes a sufficieutly large piece of wood. If this chars, there is too much gas. If, on the other hand, it burns with some degree of liveliness, there is too much air in the bed. On principle, it is always better that combustion should take place with a slight excess of air; and it is necessary to be careful to get a certain pressure in the setting. This pressure can be obtained either by reducing the draught, or by increasing the opening of the secondary-air slides, if there is excess of gas in the bed.

The retort-bed being under pressure (or under a vacuum), the amount of gas can, of course, always be increased or diminished by means of the primary-air slides or the ventilator openings in the furnace doors. Generally, it is not necessary to modify the working of the furnace doors; and the same applies to the gas-dampers, which are sometimes put at the gas outlet of the producers. In short, hot air arrives more easily at the nostril holes than gas does; and this tendency allows the proportion of air and gas to be duly regulated by a judicious adjusting of both the secondary-air and waste-gas dampers. When there is a great excess of gas in the bed, which especially occurs after clinkering the fire aud after charging the producer, it is a good thing to close the ventilator openings of the furnace-doors for half-an-hour or an hour. When the regenerators are of considerable height, this excess of gas can also be got rid of by suitably opening the secondary-air slides. There even exists apparatus which allows of effecting this alteration automatically; but its adoption does not at present appear to be practicable.

It is to be observed that if the draught of one side of the bed be increased, there may appear an excess of gas there, the presence of which can be ascertained by looking into the bottom of the regenerator. It will then be necessary to cause this gas in excess to disappear by opening a little the secondary-air dampers placed in the hottest regenerator—that is, in furnaces with double regeneration. One can also satisfy oneself that there is not too much gas in the bed by opening one of the sight-holes of the first waste-gas flues in the regenerator. If the flame is smoky, it is because there is an excess of gas. In the same way, one can be satisfied that there is not an excess of air, by putting some wood shavings into the first passages of the regenerator. If the wood quickly catches on fire, there is evidently au excess of oxygen, and it is necessary to close down a little the air-dampers of the regenerators. To carry out this test, it is necessary, of course, to prevent the outside air from entering by the sight-hole, and to close this by a little glass frame—if the sight-hole plugs are not provided with mica fronts.

With a little practice, stokers very quickly become able to tell the way a regenerative bed is working, by simply looking through a sight-hole; and it rarely happens that slides or dampers have to be touched when once the retort-bed has been well regulated. So as to prevent the stokers from too frequently touching the slides, it is a good practice to fix padlocks on them, the key of which is kept by the retort-house or works' foreman.

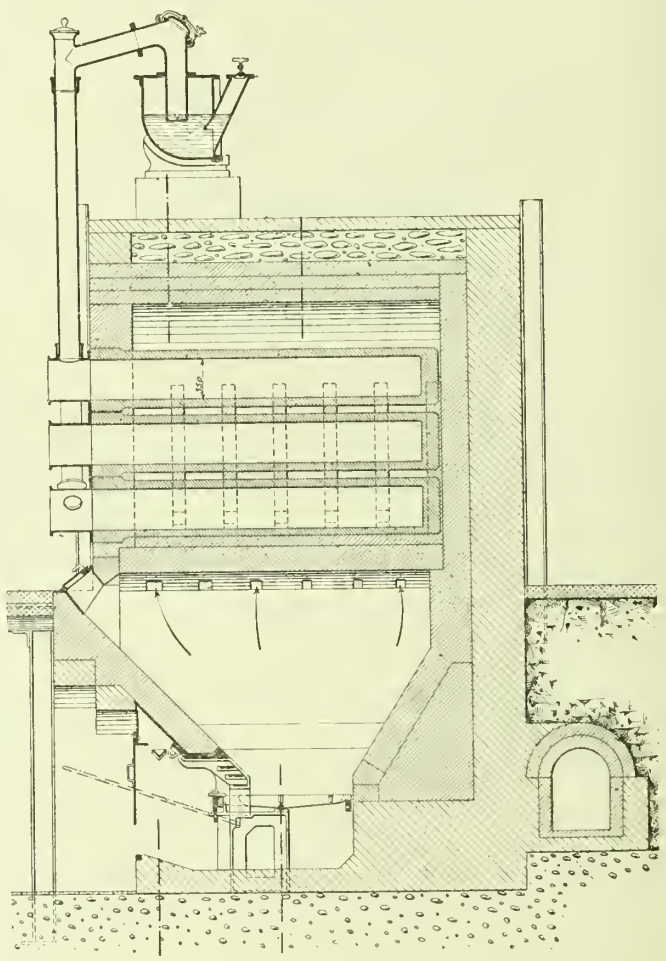


Fig. 6.—Special Furnace for Burning Coke Dust mixed with Small Coal. Section through the Centre of the Producer.

An analysis of the waste gases is also a good way by which to ascertain how the bed is working; but it must be made by an experieuced person, who is quite familiar with the retort working at different hours of the day. When an analysis is to be made, it is a good precaution to see that all the plugs and cracks in the front walls are properly stopped up, so as to prevent cold air getting into the waste-gas flues. These inlets of cold air have important effects on the working of the beds; and the greatest care should be taken to avoid them. This last observation applies equally to the front walls of the beds, especially when they are working under a vacuum—that is, with a certaiu draught or pull—which is sometimes unavoidable.

The draught ought to be regulated in such a way that the interior of the bed may be slightly under pressure, which can be

seen by the small tongues of flame that appear at the sight-holes at the top of the bed front. When producers have a small grate-bar area, this result is sometimes difficult to achieve by merely manipulating the air and gas dampers; but it is necessary to try to obtain it, because everyone admits that producer beds work so much better the more they are under pressure. Stokers must therefore take care the beds are not under suction, but that the flames always have a tendency to come out from the setting.

In retort-beds with double combustion (see fig. 4), the pressure behind the front wall ought to be very clearly marked, on account of the longer way the flames have to go before reaching the regenerator. With these beds, it is necessary carefully to avoid working under a vacuum, because too great a draught would have the effect of sucking in too much air through the openings placed behind the dividing wall of the bed, and the combustion would be too active in the bottom of the bed. In some beds of inclined and vertical retorts, which are especially suited for double combustion of gas, this inconvenience is reduced, because the second admission of air is regulated by dampers placed in front of the regenerators; but in these beds, as in beds of horizontal retorts, it is always better to increase the pressure of the flames against the front wall as much as possible, if only to prevent cold air getting in through cracks in the brickwork.

The draught of each bed being able to be regulated by the waste-gas dampers placed in the base of the regenerator, the general damper, which is placed at the foot of the chimney or at the end of the retort-benches, could be done away with. But this damper is very useful to counteract the variations which arise in chimney draughts in consequence of a change in temperature or from any other cause. A very delicate gauge, connected to the main flue between the bench and the chimney damper allows of these variations being easily corrected by altering the general waste-gas damper.

(To be continued.)

COMPARATIVE VALUES OF THE THREE FLAME STANDARDS OF LIGHT—THE CARCEL, THE HEFNER, AND THE VERNON HARCOURT.

REPORT ON THE RESEARCHES CARRIED OUT AT THE TESTING LABORATORY OF THE NATIONAL ACADEMY OF ARTS AND TRADES, AND AT THE CENTRAL ELECTRICITY LABORATORY, OF PARIS.

By M. Perot, Director of the Testing Laboratory, and M. Janet, Director of the Electricity Laboratory.

[Communicated at the Meeting of the International Committee on Photometry at Zurich, July 18-20.]

In accordance with the decision arrived at by the International Photometric Committee at its (first) congress at Zürich, M. Th. Vautier, the President of the Committee, requested the Testing Laboratory of the National Academy of Arts and Trades to be good enough to undertake the photometric comparison of the three flame standards most commonly in use—viz., the Carcel, the Hefner, and the Vernon Harcourt. The same request was made to the Central Electricity Laboratory, which had several times before had occasion to investigate the usual standards of light. A paper, published in 1898, on the comparison there of the Carcel and Hefner lamps has been quoted by Dr. Bunte in the report which he presented to the International Committee ("Journal," Vol. LXXXIV., p. 957).

Work was started, therefore, at the Academy of Arts and Trades in 1905, and at the Central Electricity Laboratory in 1906; the results obtained are summarized later. This work has been supplemented, finished, and confirmed by joint work carried out in June and July, 1906. The photometric tests at the testing laboratory of the Academy of Arts and Trades have been made by MM. A. Perot, the Director, and E. Langlet, an Assistant; and those at the Central Electricity Laboratory by MM. F. Laporte, the Assistant Director, and M. Jouaust, the Superintendent of the Laboratory.

I.—Work Carried out at the Testing Laboratory of the Academy of Arts and Trades in 1905.

Mode of Working.—The measurements have been made by the method of direct comparison in order to determine the relation between the intensities of the sources of light; an intermediate source has not been resorted to. This method has been adopted in order to depart from the experimental arrangement usually followed, and to endeavour to eliminate any systematic error which may creep into measurements habitually being made. This error might have been ascribed to the difference of colour of the sources, which is appreciable enough as between the Carcel and the Hefner. Making comparisons between the three sources simultaneously, it was possible to ascertain directly the relation between two sources, and afterwards to deduce the two other relations measured; one of the sources being regarded as an auxiliary source. It is certain that the sensation of equality of illumination for the discs when the colour is different is a physiological sensation, and that it must depend as much on the observer as on the instrument by which it is ascertained.

Representing the Carcel lamp by the symbol C, the Hefner by H, and the Vernon Harcourt by V, the measurements made in 1905 at the testing laboratory have given to the ratio $\frac{H}{C}$ a value higher by nearly 3 per cent. than that which is obtained from the product $\frac{V}{C} \times \frac{H}{V}$. It is right to assign only a relative significance to this fact, for it depends on a certain number of factors, among which the instrument by which the observations were made must have particular importance. The apparatus used for the direct measurement of the ratio $\frac{H}{C}$ was a photometer with concentric discs. In a series of experiments made in conjunction with the Central Electricity Laboratory, described further, the divergence vanished. But there were more observers, and a contrast type of photometer was used. In the series of operations now in question, the sources of light were at the points of an equilateral triangle, of which three photometer benches formed the sides. Two observers made simultaneous measurements of the ratio between two sources. The order of the observations by the operators was—

Ratio	$\frac{V}{C}$	$\frac{H}{C}$	$\frac{H}{V}$
(1)	Perot	—	—
(2)	Langlet	—	Perot
(3)	—	Perot	Langlet
(4)	Perot	Langlet	—
(5)	Langlet	—	—

Each observer made eight observations with reversals of the photometer; and the mean of all these readings has been taken for the calculation. Between each series, the Carcel lamp was emptied and fresh oil put in and the wick changed; the pentane was changed in the Vernon-Harcourt lamp every twenty-four hours; the Hefner lamp only was re-lighted just as it was for each test. The aqueous vapour present in the air was determined by means of a psychrometer; and it did not vary appreciably in the course of a test. The content of carbonic acid was found to be very low—about 2·4 grammes per cubic metre*—which involves insignificant correction. The great size of the photometer-room —15,400 cubic feet—was doubtless the cause of the constancy of composition of the air during a series of observations.

Apparatus.—Two Carcel lamps were used. They had been found to be identical, and also similar to those of the Central Electricity Laboratory and the Municipal Laboratory of the City of Paris. The precautions mentioned in the instructions of MM. Dumas and Regnault have been taken. The oil and wicks were obtained from the maker of the lamp. The Hefner lamp was brought from M. Violle's laboratory at the Academy; two samples of amyl-acetate known to be good were used. The Vernon Harcourt lamp, which had a certificate from the National Physical Laboratory, had been sent by M. Vautier; the pentane was brought from Messrs. Simmance and Abady.

The two photometers were both of the Lummer-Brodhun pattern; one constructed by Pellin is a concentric disc apparatus, the other from the house of Hartmann and Braun is a contrast apparatus. The formulæ for corrections used were those of Herr Liebenthal for the Hefner, and that of Mr. Paterson for the Vernon Harcourt lamp. The first reduced to 8·8 litres of aqueous vapour; the second to 10 litres. In the following table, the mean results of five series, comprising some 320 measurements, are given. The small letters show the value of the ratio before the corrections for aqueous vapour have been applied. The latter have considerable importance, as the tension of aqueous vapour was high.

Ratio	$\frac{v}{c}$	$\frac{h}{c}$	$\frac{h}{v}$	$\frac{v}{c} \times \frac{h}{v}$	Litres of aqueous vapour.
	1·000	0·0937	0·0909	0·0909	17·2
Ratio	$\frac{V}{C}$	$\frac{H}{C}$	$\frac{H}{V}$	$\frac{V}{C} \times \frac{H}{V}$	
	1·053	0·0988	0·0910	0·0958	

Examination of these figures calls for some comments. If the figures in the first table are compared with those generally accepted, there is good agreement; but this is not the case with the figures in the second table. These measurements, however,

* This is equivalent to about 13 volumes of carbonic acid per 10,000 volumes of air, and can scarcely be rightly spoken of as very low.—Ed. J. G. L.

have been made when the humidity was very high; and it seems that the conclusion may be deduced from this fact that the Carcel lamp has a co-efficient of correction analogous to those of the two other standards, which are quite close to one another. Until the co-efficient of correction of the Carcel shall have been determined, it would appear that an analogous co-efficient to that of the other two ought to be applied—say, 0·006 (10 − x), in which x is the number of litres of aqueous vapour contained in 1 cubic metre of dry air. In any case, its value is not independent of such a quantity. In the sequel, the uncorrected figures will be compared one with the other.

II.—Work Carried Out at the Central Electricity Laboratory (April, May, and June, 1906).

(1.) *Indirect Comparisons.*—The Central Electricity Laboratory has made a series of photometric comparisons of each of the three lamps—the Carcel, the Hefner, and the Vernon Harcourt—with one and the same incandescent lamp. The aim which the Committee have set themselves is to make measurements of intensity of light made with the different standards comparable. In order to bring the method employed for determining the ratios in question as close as possible to the application to be made of them in the sequel, it was decided to make measurements of the same intensity of light by means of the three standards.

For carrying out the tests, the regulation of an electric lamp, when the indispensable precautions are taken, is more exact and very much more convenient than that of a flame; and the use of a source of light for comparison which is independent of temperature and momentary atmospheric conditions, allows the constancy of the standard to be studied. The choice of a source of intermediate intensity offers certain advantages for the exactness of the measurements and the ease of carrying them out. The measurements were made by a contrast photometer on Lummer and Brodhun's system, made by Hartmann and Braun.

The incandescent electric lamp employed for the tests was a so-called "5-candle 110-volt," with flat filament, of horse-shoe shape. Its constancy had been proved. While having been alight for only a very short number of hours, it had been tested at different times over several years with a view to its use as a standard lamp. It was employed at a tension of 105 volts measured by means of a potentiometer, and its set was carefully preserved. The constancy of its luminous intensity was checked. Each observation comprised a series of ten readings; the photometer being reversed. The measurements were made as far as possible in duplicate, by observers who alternated photometry and the regulation and supervision of the lamps.

With sources of light of distinctly different colours, a systematic divergence has been established between the results of these two observers. In the actual case, on the other hand, the readings were always concordant—at least, every time the lamps were properly regulated. The tints of the standard are actually almost alike; and according to the results obtained, the most appreciable difference of colour (that between the Carcel and the Hefner) did not seem sufficient to cause any perceptible divergence between the two observers.

The work was begun in one photometer-room, in which the distance of the two sources under comparison was about 3 metres (9·84 feet), and it was continued in another room. The sources of light were differently placed, and the measurements were made under different conditions. No systematic error was disclosed thereby. In the second room the illumination on the photometer screen was about 2·5 *lux* when comparing the Carcel and the Vernon Harcourt with the incandescent lamp, and 1 *lux* in the measurements with the Hefner lamp.

Carcel Lamps.—The two lamps which had previously served for earlier work and had been compared with other lamps were used in this work. In the course of the work, measurements were made with another and new Carcel which was being tested, and account has been taken of these measurements in calculating the average of the results. The intensities of light of the Carcel lamp were referred to a consumption of 42 grammes of oil per hour, assuming that the intensity of light is proportional to the consumption. Twenty-nine series of measurements were made. The mean proportion of aqueous vapour was 10 litres per cubic metre of dry air, and the temperature 16° C. The incandescent electric lamp being given the symbol S′, it was found that—

Lamp S′ = 0·421 Carcel.

Hefner Lamp.—The incandescent electric lamp was compared with three Hefner standards. The one belonging to the Central Electricity Laboratory, made by Hartmann and Braun had been verified in 1906 by the Physical-Technical Institute at Charlottenburg. The other two lamps had likewise been verified in 1899 and 1904. The three lamps gave concordant results. Acetate of amyl which was known to be good was bought from two different vendors in Germany for use. Fourteen series of measurements were made. The mean proportion of aqueous vapour was 9·3 litres per cubic metre of dry air. The mean of the results obtained was—

Lamp S′ = 4·54 Hefners.

On correcting each result by Dr. Liebenthal's formula, so as to reduce the intensity of the light of the Hefner lamp to its normal value, corresponding with a proportion of 8·8 litres of aqueous vapour, it was found that—

Lamp S′ = 4·53 Hefners.

No correction was made for carbonic acid, as the photometer-room, of about 7060 cubic feet capacity, was freely ventilated about every twenty minutes.

Vernon Harcourt Lamp.—The lamp used in the tests had been bought in 1905. It was constructed by Messrs. Alex. Wright and Co., and was guaranteed to be in conformity with the prescriptions published by the Metropolitan Gas Referees. The pentane for the tests was bought in England of two different dealers. The mean of the results of twelve series of measurements made with a mean proportion of 10 litres of aqueous vapour per cubic metre, which corresponds with the normal for the standard, was—

Lamp S′ = 0·421 Vernon Harcourt.

From these figures the ratios of the three standards may be deduced; and thus the following values are obtained for the results of the indirect comparisons—

Vernon Harcourt	=	1·000 Carcel.
Hefner	=	0·0929 ,,
,,	=	0·0929 Vernon Harcourt.

It ought to be pointed out that the results found for the pentane lamp are lower than those generally obtained. It has seemed that this fact might be ascribed to a modification of the pentane used, as the residue of the liquid in the saturator was not always thrown away after each test.

(2.) *Direct Comparisons.*—With the object of verifying the preceding results, and of being able to compare them with the tests made at the Academy of Arts and Trades, the standards of light have been directly compared one with another. The simultaneous regulation of the two flames makes the tests more troublesome to carry out, errors more difficult to avoid, and, in particular, is more objectionable in that it tends to limit the number of measurements. We did not think it necessary in these tests to make corrections on account of the humidity of the air; it is tacitly admitted that the influence of aqueous vapour is the same for the three flame standards.

There were six series of measurements of the standards in pairs. The endeavour was made, as far as possible, to put them under the same atmospheric conditions. The average results were—

			Litres of Aqueous Vapour per Cubic Metre of Dry Air.
Vernon Harcourt	=	0·997 Carcel.	10·1
Hefner	=	0·0915 ,,	9·1
,,	=	0·0950 Vernon Harcourt	11·9

On correcting the last result so as to refer the ratio to standard humidities of 10 litres and 8·8 litres, it gives—

Hefner = 0·0954 Vernon Harcourt.

III.—Check and Verification Measurements made Jointly by the Academy of Arts and Trades and Central Electricity Laboratory (June and July, 1906).

With the object of verifying the preceding figures, and to be sure that the two methods lead to the same results, verification tests were undertaken in June and July, 1906. They comprised two distinct parts, referring respectively to the two methods used as described below.

(1.) *Indirect Measurements.*—The standard Carcel, Hefner, and Vernon Harcourt lamps which had been used by the Academy of Arts and Trades were compared with the incandescent electric lamp which had been used for the measurements at the Central Electricity Laboratory. These tests were made at the Central Laboratory, and later in the photometer-room at the Academy. The values found for the Academy standards fall within the series of results found for the Laboratory lamps, without there being any certainly systematic error between the standards.

(2.) *Direct Measurements.*—Direct comparisons of the three standards were made at the Academy in July, 1906. In these tests the lamps were those which had been used for the first investigation in 1905, and had now to be verified separately. The mode of working was the same. A Lummer and Brodhun photometer, from the Central Electricity Laboratory, was fitted on one of the photometer benches, which thus became each equipped with a similar photometer. The four observers—MM. Perot and Langlet of the Academy, and MM. Laporte and Jouaust of the Central Electricity Laboratory—alternately made photometric readings and supervised the standards. The readings were made simultaneously on two photometers, while one observer watched the steadiness of the Hefner flame, and another took the consumption of oil of the Carcel lamp. The observers changed alternately, in order each to make three photometric comparisons. Ten measurements were made for each comparison. The following results are the means of three complete cycles of tests by four different observers:—

Vernon Harcourt	=	1·03 Carcel.
Hefner	=	0·0925 ,,
,,	=	0·0922 Vernon Harcourt.

The average temperature was 20·5°C. (70·9° Fahr.), and there were 15 litres of aqueous vapour per cubic metre of dry air.

It seems quite reasonable to take the mean of the results obtained under analogous conditions for the direct comparisons of the standards one with the other. If certain tests *a priori* appear to carry more weight than others, they should be the last, in which the number of observers was sufficient to give good supervision to the standards. However that may be, taking the

mean of the three results obtained directly, the following figures are arrived at:—

	$\frac{V}{C}$		$\frac{H}{C}$		$\frac{H}{V}$
Academy, 1905	1·000	..	0·0937	..	0·0909
Central Laboratory, 1906	0·997	..	0·0915	..	0·0950
Verification, July, 1906.	1·030	..	0·0925	..	0·0922
Mean	1·009	..	0·0926	..	0·0927

Assuming that the three standards have the same coefficient of variation with humidity—viz., 0·006 per litre of aqueous vapour per cubic metre of dry air—it can be calculated what the preceding ratios become for the normal conditions of the standards; that is to say, for 10 litres of aqueous vapour for the Carcel and Vernon Harcourt, and 8·8 litres for the Hefner:

$\frac{V}{C}$		$\frac{H}{C}$		$\frac{H}{V}$
1·009	..	0·0932	..	0·0933

These mean results comprise, as has been shown, a sufficiently large number of tests made under various conditions (different laboratories, lamps, and observers), and they agree well enough with the ratios found by the indirect method, viz.—

$\frac{V}{C}$		$\frac{H}{C}$		$\frac{H}{C}$
1·000	..	0·0929	..	0·0929

It seems, therefore, that these ratios apply to the lamps used at the Academy of Arts and Trades and at the Central Electricity Laboratory, which are according to the specifications.

The foregoing report is signed by MM. A. Perot and P. Janet, the respective Directors of the Testing Laboratory and the Electricity Laboratory, and is dated Oct. 8, 1906.

SUPPLEMENTARY INVESTIGATION OF THE RELATION BETWEEN STANDARD FLAME LAMPS—CARCEL, HEFNER, & VERNON HARCOURT.

[A communication by M. Laporte to the Meeting of the International Photometric Committee, July 18 to 20.]

The Central Electricity Laboratory undertook a fresh series of investigations in order to verify the ratios found for the intensities of light of the Carcel, Hefner, and Vernon Harcourt lamps. After having compared the lamps available in Paris—viz., five Carcels, four Hefners, and two Vernon Harcourts—either directly or through the intermediary of an incandescent electric lamp, it seemed interesting to compare the intensity of light of the Carcel lamp as used in Paris at the Central Electricity Laboratory with the Vernon Harcourt lamp as used at the National Physical Laboratory in England, and the Hefner lamp of the Imperial Physical Technical Institute in Germany, as these Institutions guarantee the constancy of standards of light in those two countries.

Some incandescent electric lamps were investigated therefore at the Central Electricity Laboratory at Paris, and their intensity of light was compared with the Carcel lamp there. In order to expedite the comparisons, and to avoid multiplication of measurements, the lamps intended to be sent abroad were carefully compared with the incandescent lamp which had been, and is still, used in all tests of the Carcel lamp (lamp S[1]). The lamps were taken to England by MM. Laporte and Jouaust, and were tested at the National Physical Laboratory at Teddington by Mr. Paterson. The difference of potential and the intensity of the current were measured on the potentiometer, and the intensity of light was measured by the method employed at this laboratory by means of an incandescent electric lamp which had been standardized by numerous comparisons with the British standard Vernon-Harcourt lamp. Fresh measurements were made in Paris on the return from England; and the lamps were then sent to Germany. They were tested at the Imperial Physico-Technical Institute at Charlottenburg by Dr. Liebenthal. The lamps were tested in the ordinary way followed at this laboratory, by comparison with standard lamps (? electric) of which the intensity of light was determined by measurements with the Hefner lamp.

A small difference exists between the Central Electricity Laboratory and the Imperial Physico-Technical Institute as to the unit of electromotive force, owing to the legal value of the Latimer-Clark standard cell (1·434 volts in France against 1·4328 volts in Germany). Account was taken of this difference in the tension at the terminals of the lamps; they were tested at the tension of 99·52 German volts, corresponding with 99·6 volts. An analogous correction has to be made on the intensity of the current, as the potentiometer is regulated by means of a standard cell. Below are given the results communicated by the Physico-Technical Institute. It has not been thought necessary to correct them for a difference depending on a decimal which is not given by this institution. The lamps were again tested photometrically on their return to the Central Electricity Laboratory. One of them had been broken in the course of the tests. Another gave results varying from day to day; and these have not been included in the appended table. For the sake of simplification, the average values obtained at the Central Electricity Laboratory are given.

Lamp.	National Physical Laboratory.			Imperial Physico-Technical Institute.			Central Electricity Laboratory.		
	Volts.	Ampère.	Candle	Volts.	Ampère.	Hefner	Volts.	Ampère.	Carcel.
AL	99·6	0·2667	7·38	99·52	0·266	7·98	99·6	0·267	0·75
BL	,,	0·2824	8·99	,,	—	—	,,	0·2825	0·92
CL	,,	0·26945	8·08	,,	0·269	8·86	,,	0·270	0·825
DL	,,	0·2651	7·87	,,	0·265	8·78	,,	0·2655	0·82
EL	,,	0·2728	8·35	,,	0·272	9·04	Variable		
AC	,,	0·1847	3·91	,,	0·184	4·35	99·6	0·185	0·405

From the foregoing results the following values for the ratios between the three flame standards used at the different laboratories can be deduced:—

Ratio of the Standards.

Lamp.	Hefner. Carcel.	Vernon Harcourt. Carcel.	Hefner. Vernon Harcourt.
AL	0·094	1·016	0·0925
BL	—	1·023	—
CL	0·0932	1·020	0·0912
DL	0·0934	1·041	0·0896
EL	—	—	—
AC	0·0932	1·035	0·0899
Means	0·0934	1·027	0·0908
[Reciprocals	10·701	0·9737	11·013]

EXAMINATION OF RESULTS OBTAINED FOR RATIOS BETWEEN THREE STANDARDS—CARCEL, HEFNER, & VERNON HARCOURT.

[A Communication by M. Laporte to the Meeting of the International Photometric Committee, July 18 to 20.]

At the last meeting of the International Photometric Committee at Zürich in 1903, Dr. Bunte, after reviewing the earlier work on this question, came to the conclusion that the following were the most probable values:—

Vernon Harcourt . . . . . = 11·4 Hefners*
Carcel . . . . . = 10·9 ,,

The work done in Germany at the Imperial Physico-Technical Institute by Dr. Liebenthal gave as a result of the comparison of the Carcel with the Hefner the ratio: Carcel = 10·8 Hefners. The Hefner is here referred to its normal atmospheric conditions—viz., 8·8 litres of aqueous vapour per cubic metre of dry air.†

Dr. Liebenthal made no correction on the intensity of the light of the Carcel lamp; but he ascertained by direct tests that the ratio $\frac{\text{Carcel}}{\text{Hefner}}$ varies little with atmospheric conditions, and that consequently the correction to be made to the intensity of light of the Carcel was close to that for the Hefner. Under these circumstances, it is tacitly admitted that, in the previous ratio, the Carcel was under the same atmospheric conditions as the Hefner lamp, or that the humidity of the air was 8·8 litres. Correcting the intensity of light of the Carcel lamp to correspond with the atmospheric condition which is taken as the mean in France—*i.e.*, to 10 litres of aqueous vapour per cubic metre of dry air—by use of the co-efficient (0·006) of correction which is applied to the Hefner and Vernon Harcourt lamps, the foregoing ratio becomes

Carcel . . . . . = 10·72 Hefners.

[Some tests made in 1906 and 1907 at the Central Electricity Laboratory under varied and many atmospheric conditions on the question of the correction for the Carcel lamp indicated that the formula for the correction was a complicated one, and that temperature seemed to come into play. The intensity of the light increased with the temperature. Between 15° and 20° C., however, the co-efficient of variation approached the value stated for the other standards.] The ratio found for the Vernon Harcourt lamp was

Vernon Harcourt . . . . . = 10·9 Hefners.

The pentane lamp was under the normal English atmospheric conditions—viz., 10 litres of aqueous vapour per cubic metre of dry air, with 8·8 litres for the Hefner lamp.‡

The results of the investigation made in England by Mr. Paterson at the National Physical Laboratory were as follows:—

Hefner . . . . . = 0·0914 Vernon Harcourt.
Vernon Harcourt . . . = 10·95 Hefners.§

The pentane was taken as burning under the normal 10 litres, and the Hefner lamp under only 8·8 litres of aqueous vapour per cubic metre of dry air. For the Carcel lamp, the ratio found was—

Carcel. . . . . = 0·9825 Vernon Harcourt.

The tests undertaken in France by M. Perot at the Testing Laboratory, and by MM. Laporte and Jouaust at the Central Electricity Laboratory, including both direct comparisons of the lamps with one another and comparisons made through the inter-

* See "JOURNAL," Vol. LXXXII., p. 957. † *Ibid.*, Vol. XCV., p. 102.
‡ *Ibid.*, Vol. XCV., p. 102. § *Ibid.*, Vol. XCVII., p. 282.

mediary of an incandescent electric lamp, and with corrections applied to refer each lamp to its standard atmospheric conditions, have given the following average results:—

Hefner . . . . . = 0·093 Carcel.
Vernon Harcourt . . . . . = 1·005 ,,
Hefner . . . . . = 0·093 Vernon Harcourt.

Other interesting comparisons of importance have been made by certain physicists who have travelled successively to Germany, England, and France, taking with them the same incandescent electric lamps. By comparing the values obtained, the ratios of the intensities of light of the standards of each country can be calculated under the identical conditions under which they are used. Mr. Sharp, of the Electrical Testing Laboratories of New York, thus obtained, in 1903, the following results for the mean of the intensities of the light of his lamps:—

National Physical Laboratory at London 16·89 candles.
Central Electricity Laboratory at Paris . 16·2 bougies decimales, or 1·685 Carcel.
Imperial Physico-Technical Institute at Charlottenburg . . . . . 18·12 Hefners.

From these figures, the following ratios are deduced:—

Vernon Harcourt . . . . . = 0·998 Carcel.
,, ,, ... = 10·72 Hefners.
Hefner . . . . . = 0·093 Carcel.
,, ... = 0·0933 Vernon Harcourt.

Mr. Hyde, Assistaut in Physics to the Standards Office at Washington, in 1906 made the same trip; and he has recently published the results of his tests. The ratios obtained by him from the means of the values of ten lamps are as follows:—

Vernon Harcourt . . . . . = 11·19 Hefners.
Carcel . . . . . = 10·73 ,,
Vernon Harcourt . . . . . = 1·043 Carcel.

Finally, in 1907, the Central Laboratory of Electricity sent MM. Laporte and Jouaust to Teddington and Charlottenburg with incandescent electric lamps. The results of their series of measurements were—

Hefner . . . . . = 0·0934 Carcel
Vernon Harcourt . . . . . = 1·027 ,,
Whence Hefner . . . . . = 0·0908 Vernon Harcourt.

In order to facilitate comparison of the results of the different tests, they are given with calculated reciprocals in the following table. To distinguish between the figures found at the various institutions and the results which are calculated reciprocals, the latter are put in italics.

Values of the Intensity of the Light of each Lamp in Terms of the other two.

Lamp.	Researches.	Hefners.	Vernon Harcourt.
Carcel	1	10·72	*0·984*
	2	*10·73*	0·982
	3	*10·75*	*0·995*
	4	*10·75*	*1·002*
	5	10·73	*0·958*
	6	*10·70*	*0·973*
		Carcel.	Vernon Harcourt.
Hefner	1	*0·0933*	*0·0918*
	2	*0·0930*	0·0914
	3	0·093	0·093
	4	0·0930	0·0933
	5	*0·0932*	*0·0894*
	6	0·0934	0·0908
		Carcel.	Hefners.
Vernon Harcourt	1	*1·016*	10·9
	2	1·018	10·95
	3	1·005	*10·75*
	4	0·998	*10·72*
	5	1·043	*11·19*
	6	1·027	*11·01*

The researches referred to by the numbers are: (1) The German, (2) the English, (3) the French, (4) Mr. Sharp's in 1903, (5) Mr. Hyde's in 1906, and (6) those of MM. Laporte and Jouaust in 1907.

A study of this table shows that the ratio between the Carcel and the Hefner lamps is concordant; and its determination seems to suffice. For the ratios of the Vernon Harcourt lamp to the Carcel and Hefner lamps, the results of the three German, English, and French investigations differ by less than 2 per cent.; but the errors obtained in the comparisons of the lamps carried from one laboratory to another reach 4 per eent. It is difficult to say whether these differences are due to accidental errors of the measurements, or to systematic differences between the different specimens of the standards, or to different estimates of the atmospheric conditions. Under these circumstances, it seems quite enough to express the ratios of the units by two significant figures. However, as by suppressing the decimals errors might be increased when the reciprocal or the ratio of two co-efficients is taken, it is thought that it will be useful to fix at the same time the values to be adopted for the ratios and their reeiprocals. Aecordingly, one or other of the co-efficients in the appended table should be taken:—

Proposed Values for the Ratios of the Three Lamps. Value of the Intensity of the Light of One Lamp in terms of the Others.

1 Carcel = 10·75 Hefners = 0·98 Vernon Harcourt.
1 Hefner = 0·093 Carcel = 0·0915 ,, ,,
1 Vernon Harcourt = 1·02 ,, = 10·95 Hefners.

It seems that the recent work of the different laboratories has now quite established the specifications of their respective standards; and, consequently, the values of the ratios given above may be regarded as within 1 per cent. more or less.

TRANSMISSION OF GAS AT HIGH PRESSURE.

At the last annual meeting of the Iowa District Gas Association, Mr. R. H. Lawlor, of Watcrloo (Ia.), submitted a paper giving particulars of a high-pressure gas system carried out by him. He explained that the matter came before them after an explosion in their purifier-house at Cedar Falls, which resulted in the destruction of the plant. It was then necessary to rebuild there or pump the gas from the plant at Waterloo; and Mr. Lawlor gave the reasons which led them to adopt the latter course.

He said: The most important reason for adopting the high-pressure system was the ability to concentrate the manufacture of gas for the two cities in the one plant at Waterloo—thereby reducing not only the cost of production, but also the maintenance charge, which in small plants is always relatively high. Then, again, we were able to instal a booster system from the high-pressure line to supplement the pressure in the west side system of mains, which during peak-hours had become inadequate to the increased and increasing demand. Further than this, we were in a position to use residence regulators, and secure a number of suburban and rural customers who were otherwise outside our territory.

Both Waterloo and Cedar Falls are situated on the Cedar River; the stream dividing the former into two parts in population at about the ratio of 3 : 5—the larger number being on the east side, which is also the location of our plant. Cedar Falls is about eight miles distant, and on the west bank of the Cedar. In determining the location of the pipe-line, we followed the street-car line as closely as the public highways would permit—knowing, of course, that the residential growth of the two cities would be along that route.

At the Waterloo plant we installed a cross-compound automatic Ingersoll-Rand compressor, with a capacity of 25,000 cubic feet per hour, running at 180 revolutions a minute. Just outside the compressor-room, we set a baffle-plate drum with drip to condense and remove the moisture from the gas. The line is of 4-inch steel pipe, with extra heavy malleable fittings and with long expansion joints of the Dresser pattern every 500 feet.

In crossing the river, we used extra heavy steel pipe connected all through with the Dresser joints. The river crossing was laid at the lowest stage of water when it was possible to excavate a trench with pick and shovel, with drain as far as possible towards the farther side of the river, where a small drip was put in. About 200 feet from the river, we installed another baffle-plate drum, with drip for the further removal of condensation. The gas-main was laid at a depth of about 3 feet, though for experiment about two miles was covered to a depth of only about 18 inches. With this shallow pipe we experienced no difficulty last winter, nor do we believe there can be any under ordinary conditions, if proper provision is made for condensation and its removal within the first mile.

The only trouble with the high-pressure system so far experienced was the result of an oversight in that we neglected to trap the outlet of the baffle-plate drum at the plant, which allowed some of the condensation water to pass out into the line and freeze. When the warmer weather last spring set in, the ice loosened in the 4-inch line, and was driven ahead to the river crossing about 1000 feet, where it clogged up on one of the bends. Opening the end of this fitting enabled us to blow out the accumulation of ice; and it has since remained clear.

To rectify this construction, and avoid future trouble of like kind, we put in a trap beyond the baffle-plate drum that is raised 5 feet above the drum, then down again to the main. To supplement the pressure on the old west side distribution system, we ran a line of 8-inch cast pipe connecting with the various street lines which it crossed, and joined up this 8-inch line with the high-pressure line, using a Chaplin-Fulton sensitive governor for passing the gas from the high to the low pressure system. This governor is installed in an 8 ft. by 10 ft. brick pit, with two manhole covers in the top. The governor is bye-passed with a 2-inch pipe, so that if we have trouble with it at any time we can regulate the pressure with a gate-valve while repairing the governor.

To relieve excessive pressure, we put in a seal of 2-inch pipe on the low-pressure side of the governor—using for the purpose an iron box filled with zero oil, with a 2-inch pipe running down into the oil 8 inches, so that as soon as we get more than 6½ inches of pressure on the low side, the seal will blow.

For the Cedar Falls distribution we still use the pressure of the 50,000-feet holder, regulated by a Connelly automatic governor; the holder being filled directly from the high-pressure line, pumping over the supply twice a day, and keeping off the hours of greatest demand. We are well pleased with the system employed, and believe that it is doing what we hoped in effecting a material decrease in the cost of manufacture and maintenance.

Manchester District Institution of Gas Engineers.—We learn from the Hon. Secretary (Mr. H. Kendrick, of Stretford) that it has been decided to hold the excursion meeting of the Institution at Worksop and the Dukeries on Saturday, the 31st prox.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Glasgow.

[From our own Correspondent.]

Judged of by bulk, more political than scientific, yet, from a scientific point of view, of high practical value, is not an inapt description of the annual meeting of the North British Association of Gas Managers, which was held in Glasgow last Thursday. In both fields of consideration there were important subjects to discuss, which may be taken as the reason for the large turn-out of members. Besides the members, there was a notable feature in the composition of the meeting in the welcome presence of so many representatives from England. Not only was the President of the Institution of Gas Engineers (Mr. W. Doig Gibb) present—himself a Scotchman and a member of the North of England Association—but there were also representatives from the Manchester District Institution and the Eastern Counties Association—Messrs. W. Prince and R. G. Shadbolt. The happy "accident" by which they chanced to put in an appearance, it may be taken for granted, was not that Scotland is this year an unwonted attraction for tourists, nor the technical fare offered, but may be found chiefly in the knowledge that the question of affiliation with the Institution was to be once more discussed, and in the personal regard which his southern brethren have for the North British President—Mr. Lawrence Hislop, of Uddingston. Last year, only apologies for absence were received from representatives of Gas Associations in England; and the prospect was that of a gulf in formation between the bodies south and north of the Tweed. This year—largely owing to Mr. Hislop's exertions—the ranks have been closed, and solidarity among the conductors of the gas industry secured.

This remark brings up the question of affiliation, which was the most important of the non-technical subjects before the meeting. There was only a slight show of resistance to the proposal of the Committee (introduced by the President) that the Association should affiliate. Arguments were used against affiliation which have been used before and, in the view of most people, explained away. But on this occasion all that the opponents moved for was delay. The objection was not so much to affiliation, as to the way in which it was being promoted. They were willing to join, but had not been asked in the proper way. What was wanted was that the Institution should present their suit to the North British Association, as the oldest of the constitutional Gas Associations, and ask them, as a favour, to come into the tabernacle. The situation was really this, that the Institution had asked them to come in, and the invitation had been declined. There was no fresh application from the Institution, as an Institution, but the President of the Institution was present (it is true without a mandate from his Council), and he was able to give assurances as to the continuance of the Association in their present position, should they affiliate. The Association, therefore, by an overwhelming majority, decided on affiliation; and thus the question is ended, it is to be hoped happily for all parties. Last year comparison was made in the "Journal" between the Union between Scotland and England; the comparison is now complete. When the two Crowns were united, Scotland gave a thing to England; now when the Union in the Gas Kingdom has been effected, Scotland gives the first President to the united body. One can only repeat the hope that the present union may prove as beneficial as did the National one.

Before the affiliation question came up, there was a sort of foretaste of it, in the proposal to change the name of the Association from "North British" to "Scottish," and to put "Engineers" as well as "Managers" into the title. The only reason given for the change was the sentimental one of proclaiming, on the very face of everything the Association might do, that it was a national body, and thereby preventing its being regarded by anyone as a District Association. Probably were the Association being formed now, the word would be "Scottish;" but without more powerful reasons for the change than those put forward, it is as well to let the old name, by which it has been known now for forty-five years, remain; and this the Association, by a large majority, decided to do.

Another of the "political" subjects before the meeting was the formation of a Commercial Section. This was the pet proposal of the President; and he carried it unanimously. The section is to be self-supporting, and to conduct its business in private, but to report annually to the Association, who will, of course, have the power, should it prove useless, or harmful, to bring it to an end. It will be a difficult matter to work, and require careful handling. The underlying principle of such a scheme is, of course, that the strong man is to come to the help of the weak, in the disposal of his bye-products.

Mr. Hislop made an excellent President—having not a great deal to say, but saying what he had to say to the point. His address was of the work-a-day type, dealing with numerous questions which are at present engaging the attention of gas managers, and dismissing them with words of advice which, coming from a gentleman of so strongly practical a mind, are worthy of more than passing consideration. The meeting he presided over was of more than ordinary interest, both from the number of members attending, and the importance of the subjects discussed. He is to be congratulated upon his being President in a year which will be an outstanding one in the history of the Association, and also upon the way in which he carried through the business, which he himself described as delicate.

Of the technical subjects before the meeting, the members treated that of naphthalene extraction as the leading one. It was introduced by Mr. J. D. Smith, of Stirling, in a paper in which he detailed the success he has had in getting rid of the inconvenience, annoyance, and expense, by using Everitt's tar-extractor. Naphthalene is a new enemy to the gas manager of Scotland; and it was, therefore, not to be wondered at that, in the long discussion which followed the paper, the views expressed by the Scotsmen should have been tinged with proverbial Scotch caution. It was left to the friends from England to speak with confidence derived from experience. This they did; their views being received with appreciation, to be followed, doubtless, with profit to gas managers in the North.

The paper by Mr. Alex. Yuill, of Dundee, on the "Practical Management of Gas-Works," was, as its title expressed, truly a practical one. The crown of the paper was his remarks about the advantage of using a retort-house governor. On this point, he received the applause of the meeting when he described, by illustration, the benefits of the low seal. There was a disposition to treat the governor as something new; but Mr. J. Hepworth, of Edinburgh, dispelled any such notion, by the statement that his firm have supplied them, chiefly to London Gas Companies, for the last twenty years, during all of which time they have done excellent work.

Mr. J. Campbell, of Polmont, gave a most interesting, and, as it was characterized, unique paper, upon his own experiences in introducing gas to a district not before being supplied. Having a fresh field to work upon, he encountered difficulties which do not come in the way of those in charge of established businesses. But, as Mr. Alex. Wilson, of Glasgow, pointed out, the methods followed by Mr. Campbell were instructive to all. There is new ground to be broken in every area of supply; and it cannot fail to be instructive to learn what methods have been successful in working a district which has never been occupied before.

The intimation was made, towards the close of the meeting, that the Secretary and Treasurer—Mr. R. S. Carlow—had, on account of ill-health, tendered his resignation of office, as from the end of the financial year in June next, by which time Mr. Carlow will have completed twenty-one years of official connection with the Association. The prospective loss of so trusty an official came upon the members with surprise. There cannot but be regret that so long a career of usefulness should be about to close, and the regret is all the greater on account of the cause. The Association will miss Mr. Carlow, who has, all through his term of office, been most scrupulous in looking after the interests confided to him; and he has conducted himself in so genial a fashion that it will puzzle everyone to recall any instance of even a shade of anything in his bearing towards the members that was not, in all respects, helpful.

The Association meet in Edinburgh next year, with Mr. W. Blair, of Helensburgh, as President.

GENERAL REPORT.

The Forty-Sixth Annual General Meeting of the North British Association of Gas Managers, held in the hall of the Glasgow Philosophical Society, Bath Street, Glasgow, last Thursday, was exceedingly well attended; great interest being shown in a gathering at which, besides the technical work, there were a number of questions relating to the general policy of the Association put down for consideration.

Greetings and Apologies.

Mr. L. Hislop (Uddingston), the President, on taking the chair, expressed his pleasure at seeing so large a party. He said the meeting had been called for an early hour, as they had a considerable amount of business to carry through. They were very pleased to have with them Mr. W. Doig Gibb, the President of the Institution of Gas Engineers. They had also Mr. W. Prince (the President of the Manchester District Institution of Gas Engineers), and other leaders of the Institution. They had some letters of apology. Mr. Charles Hunt, the Past-President of the Institution, regretted very much that he was unable to be present, owing to business engagements; and Mr. Francis T. Cotton, of Dublin, and, among their own members, Mr. W. R. Herring, of Edinburgh, and Mr. George R. Hislop, of Paisley, and some others, wrote expressing regret at their unavoidable absence.

Report of the Committee.

The Secretary (Mr. R. S. Carlow, of Perth) read the report of the Committee. It was stated therein that the Benevolent Fund had been drawn upon during the year to the extent of £20;

three deserving cases having been dealt with by the Committee. There had been five matters of importance to which the Committee had had to give a good deal of attention. The first was the alteration of the name of the Association. The Committee gave this matter much consideration; and, after long discussion, it was unanimously resolved to take no further action in the matter. The second subject was the "M'Gilchrist Memorial." After discussion, the Committee remitted to Mr. Yuill, of Dundee, to bring the suggestion that a M'Gilchrist Memorial Fund be inaugurated before the Informal Meeting of Gas Managers, and to ask those present at it to take over the responsibility (seeing that Mr. M'Gilchrist was so closely associated with that meeting), and appoint a Committee to carry to a successful termination any arrangements which might be made. The Committee were glad to learn that Mr. Yuill had been successful in getting the Informal Meeting to take over the responsibility and to appoint a Committee, as suggested; and that they had taken action in the matter by sending out a circular asking for subscriptions. The third matter was the publication of Mr. Young's papers. The Secretary laid before the Committee a letter he had received from Mr. Alex. Bell, of Dalkeith, on this subject; and, after some discussion, the Secretary was instructed to write to Mr. Bell and ask him for some more information. The Committee wanted to know what the total cost would be for (say) 300 copies, which must include Dr. Daniell's fee, and making the book complete and ready for sending out to members and others who desired to have it. The Secretary had written to Mr. Bell, but as yet had not received a reply. The fourth subject related to the formation of a Commercial Section. After the President had read letters he had received from Mr. Meunier, of Stockport, and others, the Committee resolved to form a Commercial Section in connection with the Association, and to issue circulars to the ordinary members, asking them to join. The Committee understood that this circular was in the hands of all the ordinary members. The fifth subject was that of affiliation. The Committee decided to re-open this question with the Institution of Gas Engineers, by sending out a circular to all the members of the Association, pointing out to them the benefits to be derived by the gas industry in general, and by the Association in particular, from affiliation, so that the members could give their decision for or against it.

Roll of the Association.

The membership of the Association, including the additions made at the meeting, numbered 232—the same as a year ago.

New Members.

The following were admitted to the Association:—

Ordinary Members.—James Campbell, Polmont; James Dickson, Kelty; G. R. Hislop, Paisley; J. D. Keillor, Lochgelly; S. B. Langlands, Glasgow; W. M'Call, Iquique, Chili; James M'Leod, Kirkintilloch; W. Ritchie, Peterhead; W. J. Smith, Carlisle; W. Wilson, Falkirk.

Extraordinary Members.—J. W. Broadhead, Elland; C. Ferns, Nottingham; E. J. King, Elland; T. K. Leckie, Coatbridge; J. M'Farlane, Cardross; E. M. Stewart, Bonnybridge; R. S. Workman, Saltcoats.

The President remarked that the report of the Committee was very satisfactory, as it showed that their membership was not decreasing. It was a great satisfaction to them that Mr. George R. Hislop, of Paisley, had again consented to join their ranks.

Mr. J. M'Donald (Denny) moved, and Mr. A. M'Leod (Dawsholm) seconded, the adoption of the report; and the motion was agreed to.

Name of the Association.

Mr. J. W. Carmichael (Barrhead), speaking on the subject of the name of the Association, which arose upon the report, said he thought it had received scant attention from the Committee. There was some need for the name being changed. The objectionable words that were applied to the Association had not been obliterated. He wanted the name changed, so that they would not be mistaken for anything other than a National Association. By putting "Scottish" in the front, they proclaimed to all that they were a National Association. It was not a narrowing of the borders of the Association, but the reverse, as he was quite certain they would have members joining from all parts of the world. The Junior Association did not put "North British" into their name, but "Scottish." He proposed that the name be changed to the "Scottish Gas Engineers' and Managers' Association," or the "Scottish Association of Gas Engineers and Managers."

Mr. T. Lighbody (Renfrew) seconded. He could not understand why the Committee had decided to throw the subject overboard, seeing that the general meeting last year ordered it to be brought up this year.

Mr. A. Napier (Crieff) moved, and Mr. J. Napier Myers (Saltcoats) seconded, that the name of the Association remain as at present.

A vote was taken by show of hands, with the result that the amendment was carried by 26 to 12.

Formation of a Commercial Section.

The President said that all the ordinary members had had a circular sent to them; and, so far, 52 replies had been received in favour of, and 1 against, the proposal to form a Commercial Section. This showed that there was a demand for a section on lines somewhat similar to those which the circular indicated. He moved therefore that a Commercial Section be formed under the auspices of the Association. The expenses of working would, of course, be borne by the section itself, which would merely have the name of the Association, and would report to the Association annually as to its working.

Mr. J. D. Smith (Stirling) seconded.

Mr. J. Napier Myers, though not prepared to move an amendment, strongly disapproved of the proposal. He desired to express his sympathy with those who wished to form a Commercial Section. It showed that there was some energy among their members—that they had some degree of pushfulness in the Association, though it was 45 years of age. But the fact that they had continued for 45 years to discuss (in a somewhat academical spirit) technical matters, showed that the Association was filling a very much felt want among them. He was opposed to the introduction of the commercial spirit into the Association. It seemed to him that it savoured somewhat of the trusts and the syndicates, and those evil monsters which they had records of from America. He did not believe a meeting of gas managers in Glasgow, say once a month, would be at all helpful to them. He was disposed to think it would be rather a drawback. The cost of attending the meetings would have to be borne by the individual members; and it would be only those within a radius of (say) 100 miles of Glasgow who could possibly attend. Even to them, the cost would be considerable; and he would not be disposed to bear that outlay himself, neither could he propose it to his Company. The benefits to be derived were too intangible, it appeared to him, to lay before any Committee with a request that they should bear the cost. He would rather stick to the lines originally laid down as the objects of the Association.

There being no amendment, the motion of the President was unanimously adopted.

Auditor's Report.

Mr. R. B. Main (Glasgow), in submitting the Auditor's report, said he was pleased that the funds of the Association continued in a very satisfactory state. The General Fund had increased by £9 2s. 6d.; while the Benevolent Fund, notwithstanding the fact that the Committee had paid out £20, showed an increase of £11 10s. 6d. The Research Fund had had an extraordinary expenditure of £8 2s. 4d. The total funds were: Benevolent Fund, £384; Research Fund, £162; and at the credit of the Excursion Fund, £30—altogether £576.

The report having been adopted,

Mr. A. Yuill (Dundee) proposed that they give Mr. Main their thanks for the labour and trouble to which he had put himself during the past year, in going over the books.

Mr. Main returned thanks.

Question of Affiliation.

The President, referring to the question of affiliation, said he presumed they had all had a copy of the circular sent out by the Committee; and it would be needless to read it. He would therefore move that the Association be affiliated with the Institution of Gas Engineers.

Mr. D. Robertson (Dunoon) asked how many members of the Committee were present when it was resolved to issue the circular; and if the Committee had before them any proposals from the Institution.

The President replied that the question of affiliation was before two or three meetings of the Committee, at which all the acting members were present. They had really no further particulars from the Institution, with the exception that most of the information in the circular regarding the advantages to be derived from affiliation had been obtained direct from the Secretary of the Institution.

Mr. W. B. M'Lusky (Perth) seconded the President's motion.

Mr. A. Yuill, in supporting it, said he considered it would be of advantage to the Association to affiliate. They were there to conserve, not only the interests of the Association, but those of the gas industry generally. Various moves were being made by corporations and local authorities before the Board of Trade, such as to have the standard of light determined. The Board of Trade would naturally ask the co-operation of the Institution of Gas Engineers. If the Association were connected with the Institution, they would derive benefit in such a matter; and there might be others coming up from time to time.

Mr. J. Napier Myers moved that decision be deferred for a year. His sympathy was somewhat with the desire to affiliate; but there was a note in the circular to the effect that the cost to the Association would be five guineas per annum, the tone of which he did not like. This matter of bargaining should not come into the question at all. Though the price was a very small one to give solidarity to their voice in legislative matters, what offended him was the bringing of it up now. Two years ago the question was before them; and they decided by a large majority that they would not affiliate. The subject had been brought up twice, and he though it was too short a time to force it upon the members again.

Mr. T. Lighbody, in seconding, remarked that the first question which appealed to him was, Could they afford to affiliate? Five guineas per annum was not a large sum; but it meant that they would require to increase their subscriptions. Some 17 per cent. only of the members of the Association were also members of the

Institution. Were they to increase their subscriptions to get a few more from the North British? The Institution were taking the whole credit of being able to lay subjects before the Board of Trade; but it was taking out of the hands of the owners of gas undertakings the interests they had in them—it was taking away from their employers their standing in the matter. In one part of the circular it was said that the Association would be in a better position to secure two or three representatives on the Council; but later on it was "our representative" only who was spoken of. They were apparently to have only one representative for the five guineas. In the letters which were received when he was a member of Committee, the Institution practically reserved the right to make the Association alter their constitution; and he thought the letter Mr. Carmichael read last year showed that the Institution cast envious eyes upon their Benevolent Fund.

Mr. A. Napier (Crieff) thought this raised a serious question. They must bear in mind that they were already affiliated and amalgamated with the West of Scotland Association; and they could not "play ducks and drakes" with the Benevolent Fund of the Association.

The President read a letter from the Secretary of the Institution, dated Nov. 18, 1903, in which it was stated: "Such affiliation . . . does not involve either change of name, dissolution, or any interference in the existing management of your Association." The letter Mr. Lighbody referred to as having been read last year was only an appeal to members of the Association to subscribe to the Institution Benevolent Fund. It had nothing to do with the Benevolent Fund of their own Association.

Mr. D. Vass (Airdrie), as a member of the Institution and a supporter of affiliation, wished to make it clear that it was voluntary contributions which were asked, and not a proportion of the annual contribution to be set aside for a Benevolent Fund. He tried to raise the question in the Institution of making it a compulsory subscription, but was told that it was impossible. He was in sympathy with affiliation, and thought the advantage of unity was sufficient to decide the matter.

Mr. J. W. Napier (Alloa) wished to associate himself most heartily with the desire for affiliation, and said that he would endeavour to clear away some of the misty atmosphere in which Mr. Lighbody appeared to dwell in connection with this question. A few months ago, previous to his address as President of the Informal Meeting, he was in communication with Mr. Walter T. Dunn, the Secretary of the Institution, with regard to some of the more outstanding features of the question of affiliation; and Mr. Dunn wrote to him, as one of the terms distinctly laid down, that "the name of each District Association shall be retained, and that the management and financial arrangements of them, respectively, remain under the control of each such Association." It was surely outside the subject altogether to say that their Benevolent Fund was in danger, or that the Association, as a constituted body, was likely to be lost, in any sense whatever. Then, if they affiliated, either side could, if desired, terminate the arrangement by giving six months' notice. Consequently they were not affiliating in any permanent way, but subject to reconsideration from time to time. In the minds of a considerable number of the members, there was a latent feeling that in affiliation there might be danger to members of the Association who were not members of the Institution. He raised this point with Mr. Dunn. He knew it was a thorny question; and he wished it cleared away. Mr. Dunn wrote: "In regard to some of the members of the North British Association not being eligible to join the Institution, I may say that the Eastern Counties Association, which is affiliated, has also in one of the classes of its membership gentlemen such as you refer to." Therefore it was perfectly clear that, as the Association was at present formed, there might be members, associates, and extraordinary members, who were not in the slightest degree to be tampered with.

Mr. J. W. Carmichael supported the amendment. He could not help feeling that the advantages which were held out to them were purely supposititious. If any Bill came before Parliament, or any question before the Board of Trade, could they not as unitedly, and as loyally, give their support as if they were affiliated? Were gas directors and the members of corporations to be looked upon as ignorant men, who did not know their duties? A combined association could do good work in the matter of research, of which very little had been done in the past; and there was small prospect of much being done in the future. He did not know what to make of the selection of a representative. They were to pay five guineas, and for all that they were not to be allowed to choose their representative from any class except from the 17 per cent. who were members of the Institution. Was this right or fair? He did not think so. How many of their members would join the Institution because of there being no entrance fee? How many would be prepared to go to London, and spend £10 or £20 in keeping themselves there, and yet would not join because the paltry entrance fee stood in their way? Before any steps were taken, it was fair to the members of the Association that legal opinion be taken as to the powers of the Institution to alter the constitution of the Association or interfere with their funds. It would satisfy him, and he was sure a majority of the members, if legal opinion were secured to show that, whatever the intentions of the Institution were, they would not have the power to interfere with funds or alter the constitution. As business men, they ought to safeguard their funds. He must say he was not an out-and-out opponent of affiliation. He wanted to see it carried through on proper lines; and he opposed the motion simply because he thought the circular was misleading, and because it would bring harm to the Association. It seemed a little strange to him that the gentlemen who had taken charge of the proposal for a memorial to the late Mr. M'Gilchrist should, at the same time, trample under foot, as it were, his views upon the matter. Mr. M'Gilchrist said they had wasted time upon it, and that the repeated applications to join the Institution, when they could give them no benefit, seemed to him "absurd and idle." These words were from a man in close connection with the Institution. To go hat in hand and say to the Institution, "We have made a mistake in the past; open your door, and take us in," was surely humiliating.

Mr. T. Wilson (Coatbridge) considered that, in a word, they had nothing to lose by affiliation, but everything to gain.

Mr. A. Mackay (Montrose), as one of the younger members of the Association, considered the class he belonged to would have the greatest benefit from affiliation. He became a member of the Institution this year; and a blush came to his cheek when he saw at the meetings representatives from all the world, except from Scotland. Really the Institution had great patience with Scotchmen, in continually asking them to join their ranks.

Mr. Alex. Wilson (Glasgow) said it seemed to him the whole of this trouble started at the beginning, in the first letter which was sent to the Association describing them as a District Association. Had that letter been differently worded, there would have been none of this trouble at all. But the Council of the Institution, of which he happened to be a member at the present time, had expressed regret that the letter had been worded in this way, and made their *amende* in another letter. They might have accepted this in the spirit in which it was sent. A good deal of misunderstanding seemed to be in the minds of members with regard to the affiliation question. Even that morning, after all that had been said and written on the subject, they still had points raised which had been explained away over and over again. With regard to interference with the members or the constitution of the various Associations which were affiliated, there was no question whatever. He thought he was quite right in saying that no interference would take place with any of their rules or regulations, or with their funds. The other point mentioned by Mr. Napier, of Alloa, made it also quite clear that if they did not think it to their benefit to remain, they were entitled to retire after six months. This would be a sort of safety-valve, to let off any feeling that might arise. There was no question that the benefits to the Association would be very great. It would put them into line with all the other Associations in the country, and allow them to be heard where they ought to be heard—in the larger Institution. Why should the North British Association be merely a parochial institution? He thought the present was a most opportune time for bringing the question forward again. The President of the Institution, whom he was glad to see with them, was a Scotsman; and it would be a feather in his cap if he were to get the Scottish Association to join when he was President. The question of the number of representatives had been raised; and there was a little dubiety in the minds of several of the speakers with regard to this. The circular, perhaps, was not very clearly worded; but they would be entitled to send a member to represent the Association on the Council of the Institution, as a "district member." All the other Associations were affiliating; and there was no difficulty in their own doing it. The questions raised in the Institution dealt with general matters affecting the gas industry; and surely the gas engineer or manager was the best man to deal with such questions. What was meant by having several other members on the Council representing Scotland was, he thought, that if they were affiliated, a great many more of their members would join the Institution, and in this way they would have a better representation from Scotland, which would enable them to put others, if they wished, on to the Council. By putting their heads together, as they did in other districts, they could appoint ordinary members to the Council. At present there was not the same enthusiasm and not the same united action taken in Scotland with regard to the Institution that he had no doubt would be taken if they affiliated. It would be strange if, in future, they did not have a few members of the North British Association always near the head of the Institution, as they found Scotsmen at the head of everything else. Research work had just been mentioned. The Institution were going into this question very fully; and though they were not moving very rapidly, they were none the worse for that. They were moving in the most comprehensive way, and were dealing with matters which would be of interest to every gas association and to every gas company and corporation. Why should they not take their share in this work? He considered it would be a great pity if the Scottish Association were left out of the work; and this was what they certainly would be if they did not join with the Institution, and help them on with it. They would be left out in the cold for the sake of a small misunderstanding which took place at the beginning, and which had been cleared away. He certainly thought they should go on with the proposal to affiliate.

Mr. D. Robertson (Dunoon) did not wish to say anything in the slightest degree against the Institution. He hoped the members of that body from England who were with them would not go away convinced that they had any antipathy to them as members of the Institution, or to the Institution as a whole. It was very hard, however, to get over the fact that, at the beginning, they were put down as a District Association; and it was very hard to convince some of them that they would not be classed

still as a District Association. It would have been better if the Institution had been able to lay something before them that day—if some new proposals had been submitted to them. They were going to vote on the old question of whether they were willing to ask to be admitted into the Institution—whether they were willing to be affiliated. The word "affiliate" was a most unfortuuate one. A much better word would have been "co-operate." The amount they were to pay the Institution had no weight with him whatever; but they would be practically paying tribute to the Institution. He would much prefer that, if they were to work with the Institution, they should appoint a member to attend certain meetings of the Council, and let them pay the whole expenses of such a gentleman themselves. He supported the amendment with hesitation, because he knew certain benefits would come from affiliation; but seeing that no new information had been put before them, he was compelled, meantime, to vote for the amendment.

Mr. A. Wilson pointed out that the subscription of five guineas paid practically for one visit of the represeutative to London; but there might be four or five meetings of the Council, or even more, in a year in London, and the representative would get his expenses paid each time by the Institution. Therefore he did not think the Institution were likely to get very fat over what they would receive from the Association. It was all the other way. As to the Association paying the whole of the expenses of their representative, he was afraid that they could not do it; but this was a matter for after-consideration.

Mr. A. Waddell (Dunfermline) was of opiuion that it would be quite a mistake if they did not take this opportunity of affiliating. The reasons given against it were very small indeed, and showed, after all, that there was not anything materially wrong with affiliation. It appeared to him that those who were supporting the amendment were stauding away from that brotherliness which ought to exist betwixt all gas managers.

Mr. W. Doig Gibb (Newcastle), having been called upon by the President, took the opportuuity of thanking the Association, and the President, for extending an invitation to him to attend the meeting. There was really very little for him to say. He came there, first of all, as a patriotic Scotsman; and, secondly, as President of the Institution of Gas Engineers. Therefore he was, perhaps, well qualified to look into the question of affiliation impartially—from the one side as being connected with the Institution, and from the other side as being a patriotic Scotsman who looked with a considerable amount of pity upon anybody who had not been so fortunate in his birth. It would be discourteous of him to enter into controversy, or to attack any opinions stated upon either side; but he could not, for the life of him, consider that any argument could be brought against the proposal for affiliation. The Institution did not make money out of affiliation; they did not interfere, in the slightest degree, with the internal working of any of the Associations who had affiliated; and they had nothing whatever to do with any of their funds. The sole object was to be in touch with every Gas Association in Great Britain and Ireland, so that they could truthfully proclaim to the world that their voice was the united voice of the whole of the gas industry. To make this voice efficient, they asked them to affiliate, and to send their representative to the Council, so that, when they deliberated on schemes for research, or other big questions which they were embarking upon, they might have the benefit of local knowledge from all parts of the country to guide them in what they were investigating and how to set about it. It seemed to him to be a particularly opportune time for the Association to discuss the question, because they were now only, as Mr. Wilson had said, ou the eve of starting some large works for research; and they would like, before embarking on schemes which might take three, four, or five years for their successful fulfilment, to have the benefit of a special representative on the Council from the Association, to help them in deciding how best they could spend their money. He was sure he need not take up more of their time, but simply appeal to them to sweep aside the question as to the use of particular words, and consider, once for all, that if ever there was a time in the history of the gas industry when they should be united, and work together for a common cause, this was the time. Let them put away trivialities of wording at such a time, and give their vote according to commou sense; and if the vote were not in favour of affiliation, he should go away a very disappointed Scotsman indeed.

Mr. W. Blair (Helensburgh) gave any weight his voice might have in favour of affiliation. He was one of the oldest representatives of the gas industry in the room; and he would like to see them a thoroughly united body, in dealing with research work, or with any legislation that might be proposed on gas questions.

The President read a letter he had received from Mr. W. R. Herring, in which he said:

I am very sorry I shall not be able to be present at the meeting of the Association. I am particularly sorry, on account of the important questions that are to be raised, which affect so seriously the future utility and prosperity of the Association. With regard to affiliation, let me compliment you and the Committee on sending out such a clear and concise circular as is before me this morning. It appears to put the whole case in a nutshell; and I would earnestly urge the members of the Association to carry out the recommendations of the Committee. By doing so, they would be enhancing the importance of the North British Association, as well as advancing the interests of the gas industry in Scotland. It is not right that the Scottish gas industry should be unrepresented when important questions, such as the circular clearly sets forth, are under consideration, and others of equal importance are likely to arise at any moment.

A vote was then taken, by the members upstanding; and the result was: For affiliation, 51; for delay, 13.

Mr. Thomas Wilson asked if the decision could not be made unanimous.

Mr. Alex. Wilson said he was going to ask the same question. The amendment only asked for delay; it would be a graceful thing, on their part, that the minority should fall in with the general feeling of the meeting.

Mr. J. Napier Myers was quite willing. He had said nothing in his remarks to prevent him doing so.

Mr. T. Lighbody had not the slightest objection to this course. His only point against affiliation was the cost; and they would find that out next year, in the balance-sheet.

Mr. D. Robertson fell in with what was proposed; but, at the same time, he would have been better pleased to have been on the winning side. He did not, however, think they should carry the feeling further; and he wished to assure them that the Institution would always have the entire support of the North British Association.

The decision was then declared to be unanimous.

The President remarked that they ought to congratulate Mr. Gibb, the President of the Institution, that the decision to affiliate had been taken duriug his term of office.

Mr. Gibb said that, of course, he had no mandate from the Council to thank them for their intelligent action in the matter; but he would like to say that, as a Scotch President, their action that day had put a feather in his cap, of which he should always be proud.

Mr. W. Blair, at a later stage, moved that the President of the Association (Mr. L. Hislop) be appointed the first representative of the Association on the Council of the Institution.

This was agreed to.

The Presidential Address.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—In tendering to you my sincere thanks for the honour which you have conferred upon me by appointing me your President, I cau only express regret that I have not been gifted with the flow of eloquence which has characterized some of my predecessors in the chair. The honour to me of being appointed your President is all the greater, considering that I havc not on any previous occasion contributed anything to the transactions of the Association.

LOSSES SUSTAINED BY THE ASSOCIATION.

I cannot proceed further without first referring to the loss which has been sustained by the gas industry in general, and our Association in particular, by the deaths of Messrs. Wm. M'Crae, of Falkirk, William Young, of Peebles, and J. Hall, of St. Andrews. Mr. M'Crae, as you arc aware, was Senior Vice-Prcsident of the Association, and, had he lived, would in all probability have filled the presidential chair for the ensuing year. He was a man of strong character, respected by all who knew him, and was always ready and willing to give a helping hand to those who required it. That he had many friends was shown by the number of gas engineers who followed his remains to their last resting place in Falkirk Cemetery. As Mr. Napier remarked at the Informal Meeting in April, "he died far too soon;" and his loss will long be felt by our Association.

Mr. Young, while more closely connected with the shale-oil industry thau with gas manufacture, was one of our greatest pioneers in carbonization. He took a strong interest in all matters pertaining to the gas industry, and the papers which he read before this Association from time to time form the most valuable portion of our Transactions. If, as was proposed a few years ago, these could be published (along with his contributions to other Societies) in book form, I feel sure that the volume would prove to be one of the greatest standard works of reference of the present day. The discoveries which he made as a result of his investigations and experiments are innumerable; and the gas industry has in every case reaped the benefit. Therefore, the least that it can do is to commemorate his memory by securing the publication of these in book form, for the benefit of the young men who are yearly entering the profession. His recent experiments in naphthalene extraction, and with the vertical retort as a means of carbonization of coal in gas manufacture, are likely to be of the greatest importance within the next few years.

Mr. Hall was one of the oldest members of our Association, having filled the presidential chair as far back as 1878. In consideration of his previous services, and his high standing in the profession, he was elected an honorary member of the Association at the meeting held iu St. Andrews in 1905. The best years of his life were spent in St. Andrews, where he proved himself to bc a capable gas engineer; and he has been respousible for the early traiuing of several men who now hold good positions in the gas profession.

LACK OF INTEREST ON THE PART OF MEMBERS.

Your Committee have been greatly handicapped during the last twelve months through thc non-attendance of some of its members. Out of the ten geutlemen who were appointed to look after the interests of the Association, only six have attended Committee meetings; and this uumbcr is not sufficient to carry

on the work of the Association in a proper manner. No gentleman should be appointed a member of the Committee without first obtaining his consent. Then, if he is appointed, and has the best interests of the Association at heart, he will faithfully attend the Committee meetings to support these interests. The present method of voting is anything but satisfactory, as, out of 160 ballot papers sent out, only about 30 are usually returned. It is evident that the remaining 130 members take no interest whatever in the affairs of the Association; otherwise they would at once suggest some method which would remedy matters. If it were not for the strenuous efforts of the few who still take a prominent part in its affairs, the Association would be defunct in a very short time. Something must be done to reawaken the interest of the members; and this can only be done by the members themselves taking part in the proceedings at each annual meeting.

It has been suggested that the Informal Meeting which is held annually in April might be converted into a meeting of this Association; but I venture to think that it is its informality which makes it so gigantic a success, as we hear the voices of gentlemen there who never speak at all at our annual meetings. At the same time, we could with advantage have at least one other meeting in the year—some of the other Gas Associations can have four successful and well-attended meetings. There is a long period between our July meeting and the Informal Meeting in April, during which time many questions arise which could be discussed if we had a meeting (say) about November. No papers need be read; but any member could introduce a subject which was of general interest, and we would all benefit by the discussion thereon. When the Commercial Section comes into proper operation, it will, of course, give members an opportunity of exchanging views on any subject; but, as it will be divided into sub-sections to suit the various districts, the questions discussed will not be of such general interest as they would be at a full meeting of the Association. On referring to our rules, I find it is there stated "that the object of the Association is to devote itself to the encouragement and advancement of all matters connected with gas engineering and manufacture, and that it is established to facilitate the exchange of information and ideas amongst its members."

I venture to think that a great deal of the lack of interest is due to the fact that many of the papers which have been read during the last few years do not appeal to our members who are managers of works making under 20 millions, while these form a large proportion of the membership of our Association. Mr. Campbell's paper to-day should appeal strongly to such members as a means of developing their business; and I feel sure it will be listened to with great interest, and will receive a good discussion. Mr. Smith's paper, on "Naphthalene Extraction," should also be of interest to every member, as naphthalene troubles are becoming more numerous in Scotland, owing to the changes in the character of the coals used; and as the lower seams of coals are now being used in greater quantities, we may look for further troubles. Mr. Yuill is to favour us with his views on the "Practical Management of Gas-Works." This is a subject which appeals to us all, no matter how small our works may be, and, as usual with Mr. Yuill's papers, we shall get information and details which will be well worth listening to. It is a subject regarding which we are all supposed to know a little; and, as each manager thinks his own methods of working are the best, we should be sure of an interesting discussion.

THE QUESTION OF AFFILIATION.

As you will have seen from the circular which was sent out by the Committee to every member of the Association, that much-talked-of scheme of affiliation with the Institution of Gas Engineers is to be brought before you again to-day. There are many arguments in favour of it; but I have never yet heard any reasonable argument against it. Even if we are the oldest Association on record, we can never hope to attain the standing of the Institution; and by co-operation with them we are assisting in the protection and furthering the interests of the gas industry in general. The question of what is to be the standard burner for testing gas, also of what is to be the photometrical standard of light, is at present under consideration by the Board of Trade; and the Institution have appointed a Committee to approach them with a view of securing the adoption of the No. 2 "Metropolitan" argand burner, and the 10-candle pentane lamp as standards. We can all appreciate the result to gas companies and corporations if these standards are adopted. There is also in contemplation some amendment of the clauses in the "Sales of Gas Acts" with reference to the periodical testing and reverification of meters, and a reduction in the range of error allowed to 1 per cent. instead of 5 per cent. as at present; and no section of our industry is better suited to look after our interests in these matters than the Council of the Institution. All I would ask from the members of this Association is that to-day this question of affiliation should receive fair and unbiassed consideration on its merits, without allowing any national or patriotic sentiment to interfere with our decision.

CARBONIZATION METHODS AND RESIDUALS.

It is a matter for surprise that, considering the improvements which have been effected in nearly every other portion of a gas-works plant, the methods of carbonization have remained the same as were in use fifty years ago. The experiments which are at present being made with vertical retorts for carbonizing in bulk, will, if successful, revolutionize present methods. There is a large and daily increasing demand for furnace and malting coke; and when one considers that coke makers find it profitable to carbonize coal for coke and other bye-products alone, and can afford to blow-off their surplus gas into the atmosphere, it shows there is ample room for an improvement in our methods of carbonization. The lower seams of coal, which now form a considerable proportion of those used in Scotland for gas manufacture, are well suited for making this quality of coke; and I do not see any reason why a share of this trade should not fall into our hands. If as much attention was given to getting the best value possible for our residuals as is given to getting a large yield of gas per ton of coal, considerable benefit would be derived therefrom, and we would be in a better position to face increases in the price of coal without having to take it out of our consumers by raising the price of gas. I know of at least one works in Scotland where the net revenue from residuals is about 3s. per ton of coal more than the original cost of the coal delivered in the gas-works.

While touching on residuals, I should like to mention specially the manufacture of sulphate of ammonia in gas-works. There are few works making 10 million cubic feet and upwards where it would not pay to manufacture sulphate instead of selling the liquor in its crude state. The plant required is simple and inexpensive, and does not need skilled labour to manipulate it. In making comparisons of various works where sulphate is manufactured and the tar sold separately with others where the tar and liquor are sold mixed, I find that the revenue is in many cases greater from tar alone than in the others from the mixed product—showing that in the latter case the distiller is being paid for taking away the liquor. Sulphate can be manufactured quite as cheaply in the gas-works as in the distiller's works; and the saving in railway freight alone yields a handsome profit. There is practically no competition in selling the crude products; and we are compelled to accept what the distiller (in his mercy) cares to offer us. On the other hand, with the finished product we can always command full market value.

RETORT-HOUSE MACHINERY.

Great improvements have been effected within the last year or two in stoking machinery, more especially with the projector forms of it, which are much less expensive and more suitable for use in moderate-sized works. Where these are in use, combined with a proper scheme of coal and coke handling plant in such a manner as to almost totally dispense with hand labour, one finds ideal conditions of working. Anything which can be economically done to improve the conditions of labour in the retort-house is a step in the right direction. But there are very few works in Scotland of sufficient size to make such a scheme profitable; and we await with interest the publication of the working results of some of the more recent installations.

Retort-house governors are now being largely introduced on to the foul-main between the hydraulic main and the condensers, as a means of equalizing the suction of the exhausters. It is claimed that, by the use of these governors, an increased make per ton is obtained. But even apart from this, the fact of being able to maintain with safety a steady suction on the retorts, with a minimum of seal on the dip-pipes, and a freedom from the pulsations which result in the formation of carbon, is sufficient to warrant the expense of their adoption.

The process of condensation to which our gas is subjected still remains practically a sealed book to all of us, and it is difficult to know what forms of condensing appliances are most suitable. There is no doubt but that the method of condensation has a great deal to do with the naphthalene troubles which many of us suffer from, as in some works using a certain coal carbonized at a certain temperature one finds any number of naphthalene troubles; while in neighbouring works, using the same coal and carbonized at practically the same temperature, no naphthalene is found anywhere. The theory of keeping the gas as long as possible in contact with the lighter hydrocarbons—*i.e.*, by slow condensation—and thereby dissolving out the naphthalene, seems to be the most feasible. But, owing to the sudden changes of temperature to which we are subjected in this wonderful climate of ours, this is very difficult to carry out in practical working.

PURIFICATION.

Now that we are no longer troubled with sulphur clauses, managers are going in more for purification by oxide of iron. With efficient scrubbing plant, the sulphur compounds and carbonic acid in the gas can be reduced to a minimum; and as the carbonic acid acts as a carrier for some of the lighter hydrocarbons, its presence in the gas does not materially affect the lighting and heating value to the consumer. The cost of purification by oxide is much less than that by lime; and when one takes into consideration the extra labour required in handling the lime, and the nuisance arising from the disposal of the spent material, I venture to prophesy that the use of lime will soon be altogether abolished in gas-works, as even in the smallest works considerable economy can be effected without any structural alterations in plant.

RESEARCH WORK.

At a meeting of the Manchester District Institution of Gas Engineers in February last, the President (Mr. Prince, of Stoke-on-Trent), in the course of his address, remarked that at no period in the history of gas manufacture had Science played such an important part as it is doing to-day. Our Association has about

£170 standing to its credit in the Research Fund. We have many men in our own ranks who devote a considerable amount of their spare time to laboratory research work; and if a grant was made occasionally from this fund, it might tempt some of these men to come forward and give us the benefit of the results of their investigations. If it were left in the hands of the Committee, with power to administer the fund in this manner, we would have a much better return from it than we get from investment in corporation stock; and I have no doubt that our appeals for subscriptions to this fund would meet with a much better response.

HIGH-PRESSURE DISTRIBUTION.

Now that our streets are so much taken up with electric power cables, telegraph and telephone cables, tramways, and other accessories of later years, we have considerable difficulties to face whenever we contemplate any increase in our distributing plant. But high-pressure mains have done a great deal towards solving this difficulty. In the excellent paper delivered by Mr. R. M. Searle, of Rochester (N.Y.), to the Institution meeting in Dublin last month, the author described the ease with which a large volume of gas can be conveyed and distributed through pipes of very small diameter; and when it is required to deliver gas to some district a good many miles distant from the gas-works, the saving in capital expenditure by the adoption of this system will be considerable. The various forms of underground steel mains which are now on the market are proving to be a great boon to managers in colliery districts, where there are numerous subsidences from the underground workings. They give absolute freedom from breakage, besides which the initial cost, inclusive of laying, is less than cast-iron pipes.

COMPETITION FOR POWER AND LIGHTING.

Suction gas is proving a formidable competitor for power purposes; and it behoves us to give every facility to users of power to enable us to keep this class of consumer. It is claimed to be much cheaper per unit of horse power than coal gas; but if the expenses of cleaning and keeping the suction plant in order, together with the risk attending its manipulation, are taken into account, it is questionable if there is any economy, especially with plants of under 30 B.H.P. We are also having strong competition from large electric power companies who have sprung into existence within the last few years. These are offering electricity for power purposes in some cases at less than ½d. per unit.

Gas is still more than holding its own for street lighting, as may be seen from the number of large towns which are gradually reverting to the use of incandescent gas lighting. A splendid example of what can be done with high-pressure incandescent gas lighting can be seen in the new Kingsway in London, which forms a great contrast with the neighbouring streets where electricity is the sole illuminant. It is unfortunate that the superintendence of the lighting of many of our smaller towns and villages in Scotland is in the hands of men who have no technical understanding of what is required, and who take no special interest in its efficiency. Nothing is more annoying to the gas manager of the town than to see broken mantles and dirty lamps all over the streets. Where the street lighting is under the control of the gas manager, and with the use of proper burners and good wind-proof lamps, it forms one of the best advertisements a gas undertaking can possibly have.

TRAINING FOR THE GAS PROFESSION.

There are many young men at the present time desirous of entering the gas profession; and it is very difficult to advise them as to what course of training they should undergo. The engineer of even a moderate-sized works must now have a thorough knowledge of civil engineering, mechanical engineering, electrical engineering, architecture, building construction, chemistry, &c., besides which he must have a sound commercial training to fit him for conducting the commercial department of the gas undertaking; and when one sees the remuneration that is offered for many of the positions which have been advertised within recent years (and which in many cases is barely a living wage), it is surprising that young men entering the profession should consider it worth the years of hard work and study which are necessary to acquire even a general knowledge of the various subjects.

There are many other subjects of pressing interest which I might have touched on to day, but time will not permit, as we have a great amount of business to get through. I have perhaps mentioned some subjects which may have caused some feeling on the part of some of our members; but I have only done so in the interests of the Association, and I feel sure they will take my remarks in the spirit in which they are given. The interests of the industry in general, and of this Association in particular, ought to be the primary consideration of every individual member; and it is only by attention to these that we shall be able to keep abreast of the times, and thereby give our consumers the best possible value for their money.

Mr. W. Blair (Helensburgh) said he had much pleasure in asking the members to pass a hearty vote of thanks to the President for his able and instructive address, and also for his conduct in the chair during the past year.

The vote was heartily accorded; and the President returned thanks.

Mr. J. W. Napier said he wished to associate himself with Mr. Blair's motion, for the purpose of referring to the matter contained in the report of the Committee, of the publication of Mr. William Young's papers. He hoped that this would not be lost sight of, and that the Committee, in carrying out the instructions of the Association, would see that the papers contributed by Mr. Young to the West of Scotland Association many years ago, which were of extreme value, as well as those he contributed to their Association, and the papers he sent to the "Journal of Gas Lighting," and so on, should be included. He would like also to make brief reference to the Research Fund. He considered the occasion had arisen when the Committee should seriously consider the granting of small amounts, from year to year, to those members who desired to carry out particular investigations. The Chemical Society of London made, from time to time, contributions of from £10 to £30, to the foremost scientists of the day, for the purpose of buying apparatus and for other requirements in connection with particular research work.

Reading of Papers.

The reading of the three papers prepared for the meeting was then commenced. One of these, with the discussion thereon, will be found in another part of the "Journal;" the others will be given next week.

Thanks to Readers of Papers.

At the conclusion of the technical part of the proceedings,

Mr. A. Wilson proposed a vote of thanks to the readers of the papers. If the younger members would take a word from one of the older hands, he thought it would be greatly to their credit; and it would be vastly to their advantage if they were more free in giving papers to the Association. Mr. Campbell had set them a good example. He (Mr. Wilson) had had a good deal to do with the Scottish Junior Gas Association, and on all hands it had been admitted by the young men who had taken part in its meetings that not only had the Association benefited, but that the readers of the papers themselves had derived an immense amount of benefit from the way in which they had had to look up the various subjects. He was sure the same thing would occur in their own Association. At the same time they were all delighted to have had such an excellent round of papers that day.

The motion was cordially adopted.

Election of Office-Bearers.

The President reported that, as the result of the ballot, the following had been elected office-bearers for the year:—

President.—Mr. W. Blair, of Helensburgh.

Vice-Presidents.—Mr. James D. Smith, of Stirling; and Mr. A. Waddell, of Dunfermline.

Members of Committee.—Mr. Samuel Milne, of Aberdeen, Mr. P. B. Watson, of Wishaw, Mr. G. Keillor, of Broughty Ferry, Mr. Charles Fairweather, of Kilmarnock, and Mr. D. Robertson, of Dunoon.

Secretary and Treasurer.—Mr. R. S. Carlow, of Perth.

Auditor.—Mr. R. B. Main, of Glasgow.

Resignation of the Secretary.

The President said he had received a letter from Mr. Carlow, conveying his resignation of the offices of Secretary and Treasurer, to take effect as from June 30 next. His resignation at that time would enable him, during the winter months, to collect all the books and papers belonging to the Association, and be ready to hand them over to his successor. Mr. Carlow added that he had to thank the President, all the Past-Presidents, and the members of the Committee and of the Association generally, for their uniform courtesy and kindness in assisting him to carry on the work of the Association for the long period of twenty-one years. He should always appreciate with pride and pleasure the long and kindly intercourse he had had with the members, and would remember the many happy days he had spent with them at their meetings and excursions. He (the President) said they regretted very much that failing health had forced Mr. Carlow to send in his resignation. Meanwhile, it would fall to them to appoint a Joint Secretary and Treasurer as from the 30th of June next. According to their rules, an appointment could only be made at an annual general meeting.

Mr. T. Wilson said he was exceedingly sorry to hear the contents of Mr. Carlow's letter, and especially to learn that his resignation was on account of ill-health. He had pleasure in moving that Mr. J. W. Napier, of Alloa, be asked to take the Joint Secretaryship.

Mr. Napier said he was afraid the matter had not been sufficiently before him to enable him to at once give consideration to the responsibilities connected with the office.

Mr. D. Robertson, as one of the Past-Presidents, regretted very much to hear that Mr. Carlow intended to sever his connection with the Association. During the time he was in office, he found Mr. Carlow most attentive to his duties. He was an excellent Secretary; and he was sure no one whom they might appoint could fill the place more efficiently than Mr. Carlow had done.

The President suggested that it might be left to the Committee to appoint an Interim Secretary, when the time came.

Mr. Carlow expressed his willingness to prepare for, and to carry out the arrangements connected with, next year's meeting, as he had been doing. The date in his letter was given on account of its being the close of the financial year. By this

arrangement the members would have time to consider what they intended to do.

Mr. J. Napier Myers remarked that it was just in keeping with Mr. Carlow's character that he should voluntarily offer his services in the way mentioned.

The suggestion of the President was adopted.

Closing Proceedings.

Mr. W. B. M'Lusky, as the Past-President, presented Mr. Hislop with the President's Medal.

The President, in returning thanks, expressed the pleasure he had had at having so successful a meeting, and at having settled all their delicate questions so satisfactorily. He proposed a hearty vote of thanks to Mr. Carlow.

Mr. Carlow having briefly acknowledged the vote,

Mr. J. Hepworth (Edinburgh) proposed a vote of thanks to the Committee of the Philosophical Society, for the privilege of holding the meeting in their rooms.

This was carried, and the business of the meeting closed.

The M'Gilchrist Memorial.

Mr. W. B. M'Lusky made a statement with reference to the M'Gilchrist Memorial—speaking (as Convener of the Informal Meeting) to the gentlemen present as gas managers accustomed to attend that meeting. He said he wished to have their approval or disapproval of what the Committee appointed at the last Informal Meeting had done, in order that the Committee might be enabled to handle the matter in a practical way before the meeting next April.

Dinner and Excursion.

In the evening, the members and a large number of friends, including ladies, dined together in the Grand Hotel—Mr. Hislop in the chair. The toast of "The North British Association of Gas Managers" was proposed by Mr. R. G. Shadbolt, of Grantham; and that of "The Institution of Gas Engineers and other Gas Associations" by Mr. J. Hepworth, of Edinburgh. Mr. W. Doig Gibb and Mr. W. Prince responded.

On Friday an excursion took place, in moderately fair weather, to Campbeltown; going by rail to Wemyss Bay, thence by the turbine steamer *Queen Alexandra*, and returning by steamer and rail, *viâ* either Wemyss Bay or Gourock.

Mr. Maurice Graham.

We learn from Mr. Maurice Graham that, as from the 15th inst., he has resigned all his interest in the firm of Messrs. Graham, Morton, and Co., Engineers and Contractors, of Leeds, as he has decided to devote the whole of his time to his consulting work. He purposes making, as his specialty, gas-works construction and machinery for the transmission of materials—having had a large and varied experience in these branches during the past twenty-five years. On the 19th of October next, Mr. Graham will leave England by the P. and O. Company's s.s. *Caledonia* for a twelve months' tour round the world, visiting Egypt, India, Burmah, Australia, New Zealand, the Philippines, China, Japan, the United States, and Canada, and he intends inspecting as many of the labour-saving plants as he possibly can. His tour will be prolonged in India, Japan, and Canada. He combines business with pleasure, as his main commission is as Consulting Engineer for a large London Syndicate. On his return to London in October, 1908, he will permanently establish his office in Westminster. Mr. C. A. Goodall and Mr. W. B. Leech (both of whom have been with Mr. Graham for the past ten years) have taken over, and will carry on, the business of the Leeds firm.

Companies Wound Up Last Year.—The annual report of the Comptroller of the Companies Department of the Board of Trade (Mr. G. S. Barnes) on the working of the Companies (Winding Up) Act, 1890, for the year ended Dec. 31 last, has been published as a House of Commons paper. Mr. Barnes gives the following summary of the results of the year as regards additions to, and removals from, the register: Total number of new companies, 4395, from which should be deducted (1) the companies which went into liquidation (excluding two cases in which winding-up proceedings were stayed) 1728, and (2) companies removed from the register under the provisions of the Companies Acts, 1880 and 1900, 1759—together 3487; showing a net increase of 908 during the year.

"Ruegg's Employers' Liability and Workmen's Compensation."—We have received from the publishers, Messrs. Butterworth and Co., the seventh edition of the above-named work. The author (Mr. Alfred H. Ruegg, K.C., of the Middle Temple and Western Circuit) has divided his work into two parts, in the first of which he deals with the Employers' Liability Act, 1880, and in the second with the Workmen's Compensation Act, 1906. The text is followed by a full appendix containing the statutes relating to, and the cases decided on, the previous Workmen's Compensation Acts in England, Scotland, and Ireland; the County Court Rules of Procedure under the Act of 1906; and the Home Office regulations and forms. Mr. Ruegg has treated his subjects in a thoroughly exhaustive way, and has placed before his readers a mass of valuable information. The matter occupies 732 pages, and is followed by a useful index occupying 42 pages more.

NOTES ON NAPHTHALENE EXTRACTION.

By J. D. Smith, of Stirling.

[A Paper read at the North British Association of Gas Managers last Thursday.]

Most of us have doubtless ere now become alive to the fact that the tendency of modern Scottish gas practice, at any rate so far as the manufacturing side is concerned, is that the more nearly it approaches that of our friends south of the Border, the more we begin to appreciate and understand their particular difficulties.

In the old days, with our splint and good cannel coals, naphthalene troubles, as known in England, may be said to have been non-existent among us. Slowly, but surely, the gradual reduction of candle power, and the substitution of what one may term a more common class of coal for gas-making purposes, has brought about the difficulties of which we have heard so much from our southern friends in the past—more particularly the deposition of naphthalene in our manufacturing plant, and in some cases in our distribution system also. At any rate, such is my own experience; and after suffering considerable inconvenience, not to say annoyance and expense, I decided to introduce some form of friction extracting, with a view to ascertaining its efficiency or otherwise upon the naphthalene trouble.

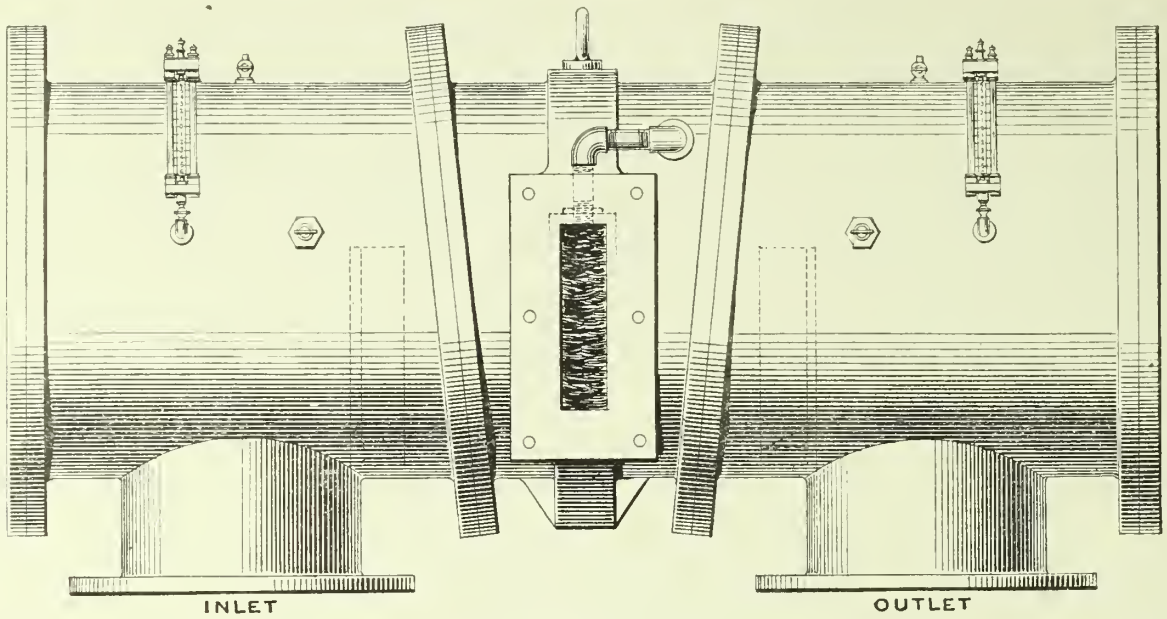
Many careful inquiries decided me to recommend the adoption of what is known as Everitt's tar-extractor—the invention of Mr. W. Everitt, the Engineer and Manager of the Ilkley Gas-Works, Yorkshire; and my sole reason for laying the matter before you is the positive manner in which this apparatus has achieved all that was expected from it. The extractor was fixed at our condenser inlet in March of this year; and though at first sight it might appear a very short experience from which to speak, still, as the present is the period of the year during which we have in the past had the most trouble—namely, April to September—and this season, up to the present, this trouble has disappeared, I venture to name the matter as of possible service to others similarly placed.

The features of the extractor which operated most in deciding my adoption of it were its extreme simplicity, the open nature of the parts offering resistance to the gas, and the ease of adjustment of the same. In practice, we find that 1 inch of differential pull is all that is required to bring about the desired result; and, in passing, let me state that no difference in either the quantity or quality of the gas made has been discovered up to the present time. Briefly, the apparatus may be described as a high-temperature-extractor; for one great essential is the maintenance of a certain minimum temperature, which keeps the tar vapours arrested there in a thin, oily condition, which experience proves to be the most suitable for the abstraction of the contained naphthalene. In my own case, for reasons of exhaust steam not being at hand, and to ensure as constant a temperature as possible, I have departed from the usual practice of heating by the use of intermittent puffs of exhaust steam, and adopted instead the use of a continuous stream of live steam. The increase of temperature between the inlet and outlet ranges from 8° to 10° Fahr.; a comparatively slight increase being all that is necessary, as the inlet temperature averages 90° Fahr. I am fully aware of the fact that this apparatus was originally designed for the purpose of the removal of tar-fog, an operation which is clearly becoming more and more important in regard to its bearing upon the remaining purification processes—particularly upon the dry purification, or rather, should one say, the purifying media?

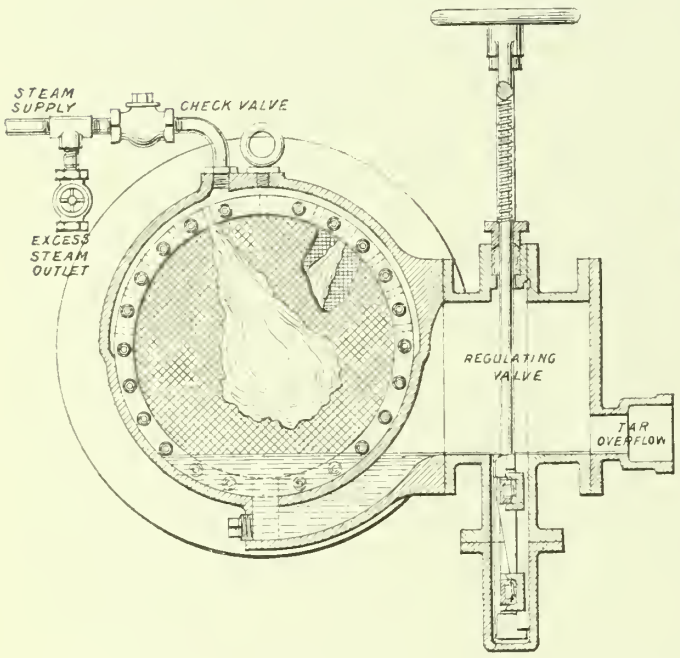
One very evident proof of the reduction of tarry matter from the use of this extractor in my own case is the greatly increased lubrication required in the exhauster as compared with that necessary previous to the introduction of the extractor. But its chief value to me lies in its effect upon the naphthalene, which, as I have already stated, has quite disappeared, both on the works and in the district of supply; the public lamps, which have hitherto shown the greatest sensitiveness to naphthalene deposits, being now quite free. During my preliminary inquiries, I was informed of one case where the distributing system taken over from another undertaking, and highly charged with naphthalene, was in a few months quite cleared by the use of this extractor.

No one would expect the apparatus to clear out the whole of the tarry matter, particularly with such a low absorption of pressure as I have chosen to work it—viz., 1 inch. Still, it does undoubtedly, to a large degree, separate the heavy tar from the lighter oils; for I quickly found that we could utilize these lighter oils to accelerate the clearance of deposited naphthalene throughout the works by bye-passing the condensers, which, as you remember, follow the extractor, thus allowing these lighter oils to travel a much greater distance through the subsequent apparatus than they otherwise would have done. Their influence in the washing apparatus and purifiers, and even in the distributing system, has been to liquefy and render harmless the naphthalene content. It is to this bye-passing of the condensers following the action of the extractor that I attribute the effective and rapid disappearance of our naphthalene troubles.

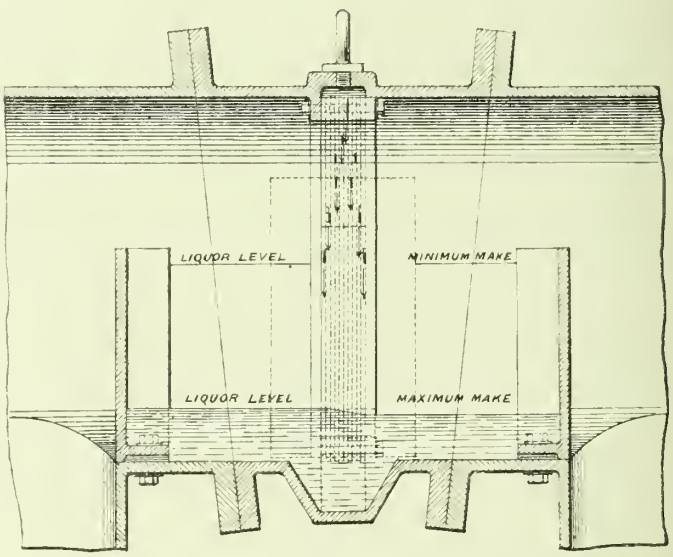
I am not in a position to state the amount of naphthalene contained in either the crude or finished gas previous to the introduction of the extractor; but latterly I have taken measures to ascertain the actual efficiency of the extractor from the naphtha-



Elevation.



Cross Section.



Longitudinal Section.

Tar Fog and Naphthalene Extractor.

lene point of view. The following may be taken as a fair example of the tests made: Sample streams of the inlet and outlet gas are aspirated simultaneously, and subjected to analyses by means of the Smith and Colman method, by which the gas is first treated with citric acid to absorb ammonia, and afterwards with picric acid solution to absorb naphthalene; the solution containing the picrate precipitate being titrated with barium hydrate, using lacmoid as an indicator. The result shown is—

Inlet gas contained	. . . . .	43 grains per 100 cubic feet	
Outlet gas	,, ...	19·7	,, ,, ,,

giving 54 per cent. efficiency as a naphthalene extractor.

Of course, the actual remaining naphthalene content in the finished gas is of little use as an indicator of the deposit limit, as this must always depend upon the quantity of solvents in intimate contact with it. But once the overloading point is reached, the most rational course is to utilize the solvents contained in the crude gas at the earliest possible moment; and, these once extracted, well saturated, little trouble is likely to ensue.

The thanks of ourselves and others are certainly due to Mr. Everitt, who raised this question in such a practical and simple form (I think about six years ago) when his apparatus was originally designed. Reference should also be made to the report on this question so ably compiled by Messrs. White and Clary, of the Michigan University, who were among the earliest to clearly point out the value of hot tar as a solvent of naphthalene; and I would further remind you of the valuable contribution bearing upon the question by Messrs. Clayton and Skirrow, submitted to a recent meeting of the Manchester District Institution of Gas Engineers, in which I could have desired some tests of the efficiency of the apparatus I now refer to had been submitted, as I am perfectly satisfied of its efficiency as an extractor of suspended tarry matter, though not in a position to demonstrate it in such a scientific manner as the authors of the paper alluded to. Further research on the lines laid down by them is imperative.

As I believe this is the first extractor of its kind to be introduced into Scotland, possibly a brief description of its action may not be out of place. The principle upon which it is constructed is more that of the strainer than of impact; the gas having to work its way through a series of fine gauze discs. But in addition to the process of straining or sieving, is that of buffeting the gas about in the spaces between the gauze discs, which is effected by means of a number of jets of steam—either live steam or exhaust if convenient—the jets playing downwards, but at varying angles from the vertical. The action effects a threefold purpose—viz. (1) A whirling movement against the faces of the discs, as well as the passage through, thereby increasing the efficiency as a tar and naphthalene remover; (2) the maintaining of a temperature necessary to keep the naphthalene in a soluble condition and the tars more liquid; (3) the cleaning of the gauzes. Incidentally, I may state that the quantity of steam necessary to effective action need not have any ill effect upon the strength of the ammoniacal liquor.

The method of drawing off the deposited liquids is of the simplest; an ordinary hydraulic main weir-valve being all that is necessary. With a light make, the valve would be almost closed; thus raising the level of the liquid and reducing the exposed part of the discs; while at full capacity the valve would be opened wide, exposing the full area of the discs—the best rate of the flow of gas as observed by experience being the determining factor. In my own case, 1-inch differential pressure or pull is taken as the indicator.

The simplicity of construction and action will, I think, appeal to all; and if my brief narrative should be of benefit to any of our members, I shall feel justified in having claimed your attention.

Discussion.

The President hoped that, as the subject was one in which they were all more or less getting interested, there would be a good discussiou.

Mr. J. M'Leod (Kirkintilloch), in opening the discussion at the request of the President, said he had never made experiments with naphthalene deposits, for the simple reason that they never had such deposits; but he had highly enjoyed Mr. Smith's paper, and it was very interesting to hear how he had dealt with the problem. There was only one point—he noticed it recently, when on a visit to Birmingham—and that was that the oil they were using there for the removal of the naphthalene did not take it all out. It merely volatilized it to a certain extent, and carried the naphthalene along with the gas. There seemed to be a general idea that the naphthalene-extractor was an apparatus for extracting the naphthalene entirely. This was not quite correct. The naphthalene only went into a solution with the extracting oils; but the oil itself volatilized, and acted as a carrier for the naphthalene with the gas.

Mr. Thomas Wilson (Coatbridge) asked Mr. Smith whether the system was first put in use as a tar or a naphthalene extractor. He had a similar apparatus—not quite the same, but it served a like purpose—a Livesey tar-extractor; and it was one of the most efficient pieces of machinery they had in the place. It took out the last trace of the tar. It was after the condenser, not before it. He was astonished to hear that anyone in Scotland had been troubled with naphthalene. He never saw naphthalene in Scotland except once, when they were using two cargoes of Newcastle coal, at the time of a miners' strike. He had, however, had some experience with it in England. He had had to steam 18-inch pipes twice a day; but this was due to the class of material they were using, and to the heat they were distilling it at.

Mr. A. Yuill (Dundee) said the subject was one which had forced itself upon them for their consideration. It was one of the points he touched on in his paper. He possibly might have said more about it had he not discovered that Mr. Smith was going to deal with the question. Mr. Wilson had just given him, so to speak, a text to speak upon. He was pleased to learn that Mr. Wilson had not had any trouble with naphthalene, in one sense; and it was unfortunate for Mr. Wilson, in another sense, that he had not, because it was well known that if they worked with high heats, and used a coking coal, as they had in Scotland, they would have naphthalene. He would rather have naphthalene, with a higher yield, and with the trouble of taking it out, than of working at lower heats, and not have naphthalene. The whole thing came to be a question of heats. It sometimes presented itself in such a manner as they could see their way out of it. Mr. M'Leod mentioned that some had gone on the lines of trying to keep the naphthalene in suspension. This could only be so if they allowed the vapours of what they termed the lighter oils to remain in suspension. But this was sometimes difficult to do. If they considered the process of condensation from the retorts right on, they had the thick tars deposited first; they then got the other tars, of a different gravity, in the condensers; and sometimes, no doubt, they would be surprised to get tar even after the condensers and washers. It was the tars they got in the scrubbers that they would like to keep in the gas, if they would not have trouble, because it was these tars which, in a volatile state, had the property of keeping naphthalene in suspension. They all knew the value of naphthalene for its light-giving properties; consequently they did not want to lose it—and they could only keep it by maintaining the vapour tension in the gas right on to the burners. Some of them discovered a method of keeping the naphthalene in suspension in a scientific way; but the experience was gained in a practical manner. It was discovered that, in allowing the tar to travel back to the condensers, they at once got rid of naphthalene; but, at the same time, they were losing some of the hydrocarbons in the gas. The way in which Mr. Smith had dealt with it was more scientific. Mr. M'Leod mentioned that it was not advisable to take all the naphthalene out. They did not want to take out the naphthalene if they could keep it in; and one way this could be done was to impart to the gas, if they thought it advisable, the vapours of a light hydrocarbon oil, so as to raise the vapour tension to such a point that the naphthalene would remain suspended in it. He had done so; but, even with this, he was not able, with the large volume of gas that was going out, to add a sufficient quantity of the tar-oil vapours, so as to retain all the naphthalene in suspension. Although he put in two or three barrels of the oil in a day, still he was troubled with naphthalene. He had only had the Livesey washer erected for a week, and was not in a position to give them any data about it; but some others who had had experience with it might perhaps put their results before them, so that they would be able to consider all the points.

Mr. W. Prince (Stoke-on-Trent) expressed his gratification at being present as representing the Manchester District Institution of Gas Engineers. They had before them the kind of subject which was conducive to the education of the profession. He felt sure they had had enough of the threshed-out systems of how to manage their works, and the several component parts of the works—purifiers and the like. But in dealing with such a trouble as naphthalene, Mr. Smith was on a theme which would repay him for all his trouble, and which they could all discuss with profit to themselves. He could not say, like many of his Scotch brethren, that he had never had any troubles of this sort. He had had, he thought, his full share of them. For the last 25 years naphthalene had been ever-present with him, as a great curse. He had attempted many solutions of the problem. He had not adopted the Everitt method; but he had reason to believe that any such form of wire-drawing the gas would tend to free it from naphthalene at least. He had been a devoted follower of the system advocated by their friend Mr. Colson, of Leicester; and he firmly believed that it was one of the finest means for removing the trouble they had to contend with. They rarely had so much as 10 grains of naphthalene per 100 cubic feet of gas; and he might say that they made a special point of testing for naphthalene, just as they did for sulphur or any other compound. He went through the works at Leicester several years ago, to see what the wonderful discovery was which Mr. Colson had claimed; and it was on the same lines, he thought, that Mr. Yuill was going. The Livesey washer was employed. He introduced into it something like 80 gallons of a creosote solvent, which cost, at the present time, about 3d. per gallon. This was, of course, returned, after separation, to the tar-well; and they obtained something from this source, in the way of economical production. With Durham coal—he was speaking now of his Darlington experience—they regularly had, during the winter part of the year, from 2000 to 5000 complaints per day from 9000 to 10,000 consumers. This was very serious; and over and above that, perhaps one-half of the street lamps were of no effect. He never knew a place where they had so much trouble as at Darlington, with Durham coal. In Staffordshire, they had, he thought, six works within a radius of 12 miles, all using the same coal, from the same collieries, and at the same price. One works would be troubled with naphthalene; while another would not see a trace of it. Newcastle-under-Lyme was immune; but Stoke-on-Trent had all the anxiety and worry of naphthalene. He had, in the manufacturing process, to carry the gas across a canal to the purifying station. He had had an 18-inch main there, with just 1 inch of room on the top of it left for the gas to go through; the rest was solid naphthalene, which had to be shovelled out. Mr. Wilson had told them that he had had to steam twice a day. He (the speaker) had had the same experience—very much of it. It led them to think what was the cause of the trouble, when they were all using the same class of coal, and when they found that one man's plant was free, and another's was saturated with naphthalene. Mr. Yuill had said he would rather have naphthalene, with its attendant troubles, than a low yield of gas. He should like to call Mr. Yuill's attention to the experience at Sheffield, where they had probably the cheapest gas in the world, the lowest yield of gas per ton, and the greatest trouble from naphthalene. So it was not at all an established fact that, with a low yield of gas, they had immunity from naphthalene. In Newcastle-under-Lyme, they made something like 12,000 cubic feet per ton; and they had no naphthalene. He was content to leave the hydrocarbons in, and to take gas to the extent of 7500 cubic feet per ton; and he got naphthalene. It was one of the most difficult things to reason out why it occurred at one place and not at another. Probably Mr. Shadbolt would be able to tell them something about it. Mr. Yuill had expressed his views as to one *modus operandi* which, he believed, Mr. Shadbolt claimed as his own—that was, to retain the light oils, and so enrich at very little cost. Mr. Shadbolt was a great success in some things. He did not know that he had yet reached everything that he desired; but they all strove, to their very utmost, to elucidate schemes and means for not only improving their business, but for also bringing in good dividends. He could talk upon this subject for any length of time. He introduced it in his Presidential Address to the Manchester Institution last February.* He sincerely trusted that the action which their Association had taken that day, in agreeing to affiliate, would have the effect of bringing the best brains they had in Scotland to the Council of the Institution. He would assure them they were desirous of getting the best possible light upon this subject. He hoped the Institution would persevere with the efforts made by the Southern District Association, for the elimination of this serious naphthalene trouble. It was a most complex problem, and it deserved all the attention it was receiving to-day.

Mr. R. G. Shadbolt (Grantham), in the first instance, as ex-President of the Eastern Counties Gas Managers' Association, offered them hearty greetings. The Gas Associations of the United Kingdom, he said, were gradually overlapping, until one found himself, as he did, a member of the Eastern Counties Association, of the Manchester District Institution, one of the Irish Association, and a visitor to the North British Association. Districts were beginning to lose their individuality, and to merge into one great whole. There was not the least doubt that District Associations had their great uses, in dealing with problems which occurred in, and which were peculiar to, the particular localities. It was certainly interesting to those of them who were visitors, to see that they were beginning, in Scotland, to experience the same troubles which they in the South had been accustomed to face for some considerable time now. He would just like to give them, as briefly as he could, his own view of the naphthalene bogey. Everyone had a right to his opinion; that was a thing of which no man could rob him. Bearing in mind the great work and the valuable contributions of their late respected member, Mr. W. Young, the researches of Dr. Colman in connection with the Southern Association, and the contributions of others on this particular problem, it appeared to him that they had to deal with the question, or that they had a choice of dealing with it, in three distinct ways. They all made naphthalene, of course. Even Mr. Wilson made naphthalene; but he somehow managed to get it through to the consumers' burners. Mr. Wilson had a great percentage—which would in all possibility astonish him—of

* See "Journal," Vol. XCVII., p. 528.

naphthalene in his crude gas; but fortnnately for him, Nature effected a cure which others were called npon to provide by artificial means. They had to assist Nature; in Mr. Wilson's case, Natnre assisted him. But still, naphthalene was there. The first method he would mention of dealing with deposited naphthalene was to nse the light oils, or the vapours, or whatever they chose to term them, which were capable of dissolving the naphthalene and carrying it down. Mr. Smith had commenced at the right end, to his mind, by endeavouring to remove the excess of naphthalene by the first of the three alternatives. The next method was to utilize solvents, of whatever character they might be, in abstracting the naphthalene, or a portion of it, after it had further proceeded on its course, and taking it out by this means. The third option was—bringing one's miud to the conclusion that, after all, the percentage of naphthalene was not very great, and, as Mr. Yuill said, it was of some value if they could retain it—the introdncing of a certain vapour to retain it, cither in a vaporous or semi-vaporous condition, and passing it on to the cousumers' burners. He took it that each man must deal with his own peculiar difficulty in his own peculiar way, and decide as to which method, under the circumstances, would be the best.

Mr. W. B. M'Lusky (Perth) had had some experience in the elimination of naphthalene. In a question of this kind their experience of to-day might be of very little value a year hence. It was rather a hnmiliating thing to see, twelve months afterwards, the silly things they had said as the result of immature experience in the beginning. He had never had more than 8 grains of naphthalene in his gas; and he had had no stoppages. His difficulty at present was that the naphthalene had got a start in Perth. It had affected the holders, and, he might say, particnlarly in one of them, where there was no trnssing, they found very little trace of it. They had another holder—a very strong one—about twenty-five years of age, which contained pretty substantial trussing; and they fonnd this holder contained about as much naphthalene as would occupy them for years to come. Their scheme was to keep the holders very low in summer, and then, in the event of a sudden rise of temperatnre, they had the smallest content possible of the holder exposed to the rays of the sun. They had no naphthalene in the gas-works, nor had they had any for eighteen months. They had managed to eliminate it by washing with tar from Pintsch's oil-gas process. This was introduced, not so much to eliminate naphthalene as to carburet air for the revivification process in the purifiers; but it happened that when they started to test for naphthalene, they found the first two or three limbs of the vertical pipe condenser very much freer from naphthalene than other parts of the works. Their first experience of naphthalene in the works was in connection with some tower scrubbers. They found naphthalene in solid form at the ontlet from the columns. They treated this pipe with tar, and found that they were clear to the holders; but in warm weather—from May to September—he had to be very carefnl to add solvents to the gas. Till last January, he had not used anything but benzol for this purpose. In the hope of benefiting by Mr. Shadbolt's cxperience with Bourne's "Gazine," he had tried it in the gas-works, with no result whatever—which was just another evidence that the conditions that they had were different from Mr. Shadbolt's conditions. Now, however, after a visit which he recently paid to one of his friends who was there from the South, he had enlarged his experience; and he had never had more than two stoppages in a day during the past summer. But perhaps the most interesting experienee he had had was in watching others; and he believed that Mr. Bell's system, at Derby, was the simplest and most efficient he had seen. Mr. Glover's method, at St. Helens, was very much on the same lines—and who shonld say which was the best? He could not tell; but certainly both these gentlemen could command a sueeess which, he was sorry to say, he conld not do at the present time. Mr. Bell had a scheme whieh was practically on all-fours with that one. Mr. Bell nsed the first eolnmn of an annular eondenser, taking away the inner tube, and employing the outer one as a scrubber. He pumped into it the residnal tar from the Pintsch's oil-gas process, with a temperature of 170° Fahr. for the incoming gas. Mr. Bell found that this did not give sufficient area; bnt he had another process, which was qnite clearly distinct from the last one. This was the process which they had had at work iu Perth for two months now; and it was a very simple one. They had to nse "Lncigen" oil, from the Scotch blast-furnaces, or the naphtha which Mr. Bell had speeially prepared, coming over at abont 200° C. This naphtha, used in a washer, with an addition of 10 per cent. of benzol, seemed to do the work in reducing the stoppages. He did no know that he could say more. If he had learnt anything, it was at their disposal; but he would caution anyone listening to him not to be guided by what he had said, because another's cxperience might be totally different from his, and his experience might possibly be of no help to another. He had no fear of success being secured in the long run.

Mr. Prince asked Mr. M'Lusky if he would tell them wherc he used the oil. As he had indicated, it was at the top of the Livesey washer.

Mr. M'Lusky said he commenced using blast-furnace "Lucigen" oil on the top of the Livesey washer a year ago last April; pntting in about 1½ inches of the oil. But later on, he emptied the last bay of a Holmes mechanieal scrubber-washer, and used oil there instead of water; leaving the second bay empty. He got that from Mr. Bell. He had never nsed oil in a Holmes scrubber-washer until then. Previously he had been content to use it in a Livesey washer. But in Jnne last he put in a Livesey washer, specially on the naphthalene plant, at the meter-outlet. Mr. Bell advised the placing of the apparatus at the meter-outlet because, if put on the scrubber outlet, the purifiers cleaned ont the solvent; and it was better they should get it through the station meters, aud away to the gasholder.

Mr. Prince said that, for their information upon this topic, which he had very much at heart, he would like to tell them that another friend of his had had the greatest possible success by introducing soft soap into the Livesey washer. It seemed silly, but it had cured his naphthalene trouble. He had not gone the length of trying it himself; but his friend spoke of it with the greatest possible confidence, and he was making somewhere about 300 million cubie feet per annum.

Mr. J. Bond (Southport) thanked them for their invitation to be present. He had had no trouble with naphthalene during the 22 ycars he had been in the district; but he had made investigations, and found that a certain amonnt of the naphthalene was dissolved by the oils contained in the ammoniacal liquor. As a great quantity of ammoniacal liquor was used for washing the gas, especially during hot days, when the sun's rays werc pouring down on the scrubbers and washers, a large amount of the naphthalene was given up from the liquor. Apart from this, and a few investigations regardiug the testing of naphthalene, he had had no cxperienee, as he had not been troubled with it.

Mr. T. Wilson said they were told that if they used coking coal, at a high temperature, they were bound to have naphthalene. They did not use a ponnd of anything else at Coatbridge; and they had never seen less naphthalene in their mains and plant. It must be very confusing to many Scotch managers who had never seen naphthalene, to hear such statements made. He might tell them it was in Hull that he had his cxperience with naphthalene. There, whenever their yield rose, they had naphthalene troubles; bnt so long as they distilled at a low temperature, they were free. It was very cnrions. He had no donbt that naphthalene existed in the gas at Coatbridge; bnt it went to the consumers, and his experience of gas making was that it was not always profitable to distil at a high temperatnre. It was a matter of £ s. d. He found if he extracted 1000 cnbic feet more from a ton of coal, he was taking out of it what wonld go to the tar-well. It was all very well, in England, where they supplied 14-candle gas, to do so; bnt it was different in Scotland, where they supplied 22 or 24 candle gas.

The President thought they were specially indebted to their English friends for the information they had given them on the naphthalene question. Their experience on the snbject was of very much more importance than anything they had yet had in Seotland. In Scotland, they were only at the beginning of their troubles; and, as the lower seams of coal came to be worked, they were bound to have more experience with naphthalene in their gas-works.

Mr. Smith, in closing the discnssion, said a minor matter which had come under his observation was the freedom from this sconrge where pipes were coated on the inside with some preparation of tar and pitch. It was his experience to note that the greater number of stoppages were in services leading from old and nncoated pipes; and he could well understand that the solvent action of the hydrocarbons in the gas upon the tarry coating would cause flakes of naphthalene to adhere and not fall again into the flowing stream of gas, and their disposition to still cling to the coating would be mueh greater in the heat of noonday than of similar flakes clinging by capillary attraetion to an nncoated pipe. The late Mr. Yonug's idea was to distil a portion of the coal at a low heat, in order to manufactnre a greater quantity of light oily and tarry matter, and then to wash the mixed gases with the light oils suitable for naphthalene extraction. Yet if a like result could be obtained by utilizing antomatically the tarry matter naturally found in the crude gas, a great amount of attention aud expense would be saved. In his (the speaker's) own ease, the results show that there was sufficient oily matter in the crude gas, if properly used, to render the contained naphthalene harmless. He heartily thanked them for the manner in which they had received this his first contribntion to the proceedings of the Association.

In the "Journal" last week (p. 267), it was annonnced that the Anchor Tube Company had been registered as a limited liability undertaking. We learn that, after many years of faithfnl service, Mr. John Hicks and Mr. William Jones have been appointed Directors; and the former gentleman will also discharge the duties of Secretary. Mr. Joues, as some of our readers may be aware, is a partner in the firm of Messrs. Thomas Cash, Son, and Co., of Birmingham.

We learn that M. Gustave Canet has been elected President of the Junior Institution of Engineers, in succession to Mr. W. B. Bryan, M.Inst.C.E., the Chief Engineer of the Metropolitan Water Board, and that he will deliver his Inaugural Address on Monday, the 18th of November. M. Canet, as some of our readers may be aware, is connected with the celebrated Schneider-Creuzot ordnance works at Havre. His address will be on "The Latest Improvements in English and French Modern Artillery."

PHOTOMETER UTILIZING THE COSINE LAW.

At a Recent Meeting of the Physical Society, Mr. J. S. Dow described a form of photometer in which the cosine law is utilized. It is therefore unnecessary to move either the photometer or the sources of light. The adjustment of the illumination of the photometrical surfaces is carried out in the photometer itself by the rotation of a Ritchie wedge about the boundary-line between the photometrical surfaces as axis. The ratio of the candle powers of the two sources of light compared can then be read off on a suitably calibrated scale attached to the photometer. This type of instrument is very convenient; but, according to an abstract of Mr. Dow's communication in the "Chemical News," attention was drawn to the possibility of "angle errors" and means of avoiding them. The instrument could be used on the "equality of brightness" principle, or, by utilizing an oscillating lens, as a flicker photometer. The results of using these two photometrical methods were, in this case, in very good agreement. Yet this might not have been so if a different portion of the retina had been utilized, especially at low illuminations.

An experiment was shown illustrating the behaviour of the "rods" and "cones" as regards flicker. At strong illuminations, when the cones are predominant, the perception of form and colour is most acute when the central portion of the retina is utilized; but at low illuminations, when the rods are in action, visual acuteness is best when the outer region of the retina is used. In the same way the perception of flicker was demonstrated to be only most acute over the portion of the retina removed from the centre of the eye when a weak illumination is employed. A distinction must be drawn between "rod-flicker" and "cone-flicker."

Some experiments were shown illustrating the detail-revealing powers of red and green light. A green or blue surface loses in luminosity as the image of it fades more and more towards the centre of the retina. But apart from the question of luminosity, the red end of the spectrum gives the best definition in the case of distant vision, and the blue end in the case of very close vision, This arises from the want of achromatism of the eye. Two exactly similar patches of red and blue light were thrown upon a screen on which a black and white chess-board pattern had been traced. The black and white squares were then seen to be more sharply defined when illuminated by the red light, in spite of the fact that the illumination due to the blue light was much the brighter of the two. The red end of the spectrum is therefore, in general, the most effectual portion for the illumination of clocks, shop-signs, and objects which must be viewed from a distance.

The author was complimented by Mr. Patterson upon his paper and the experiments shown. With reference to the instrument, he asked if the cosine law was trustworthy at very acute incidence of the light. The unequal sensitiveness of different parts of the retina accounted for the fact that it was possible to obtain different balance-points by fixing attention on the different sides of a Ritchie wedge. Mr. Dow, in reply, said he had only worked with photometers with wedges of 90°; but he was certain that the cosine law would not hold at acute incidence, on account of the large amount of regular reflection.

APPLICATIONS FOR LETTERS PATENT.

15,635.—Lemétais, J., "Apparatus for heating water." July 8.
15,722.—Hailwood, J., "Mixture of cementing materials to be used in the place of ordinary fire-clay." July 9.
15,766.—Gameson, C. H., "Regenerative furnaces." July 9.
15,776.—Reiss, C., "Inverted gas-lamps." July 9.
15,818.—Greenwood, A., "Pipe-union." July 10.
15,851.—Hallows, H., "Street-lamp post." July 10.
15,871.—Parker, T., "Production of gas from volatile hydrocarbons." July 10.
15,872.—Parker, T., "Manufacture of fuel." July 10.
15,893.—Blaser, F., "Lighting gas from a distance." July 10.
16,024.—Bray, J. W., "Gas-lamp fitting." July 12.
16,069.—Rudd, A., "Incandescent burners." July 12.
16,094.—Broughton, H., "Incandescent burners." July 12.
16,095.—Boys, C. V., "Controlling the movements of fluid-operated pistons." July 12.
16,133.—Hinch, J., and Brooks, B. W., "Anti-vibrator gas-nipple." July 13.
16,155.—Pinchbeck, J., "Gas-meters." July 13.
16,213.—Russell, R. J., "Gas lamps and burners." July 15.
16,262.—Wilson, F. W., "Rotary engine designed for use with steam, gas, or water." July 15.
16,287.—Schneider, J., "Regulating the pressure or degree of vacuum in gasholder bells." July 16.
16,299.—Sauer, P., "Union joints." July 16.
16,303.—Franks, E. A., "Manufacture of coal gas." July 16.
16,342.—Tangyes, Ltd., and Robson, J., jun., "Gas-producers." July 16.
16,343.—Browne, A. F., "Discharging continuously working vertical retorts." July 16.
16,380.—Helps, G., "Incandescent burners." July 17.
16,397,—Haughton, A., "Suction gas-producers." July 17.
16,496.—Garner, W., "Gas cooking-stoves." July 18.
16,583.—Humphrey, H. A., "Firing kilns by gas." July 19.
16,619.—Boys, C. V., "Controlling the movements of fluid-operated pistons." July 19.

REGISTER OF PATENTS.

Gas-Fired Pottery Kilns and Ovens.

Twyford, T. W., of Hanley, and Moore, T. C., of Stoke-on-Trent.
No. 18,769; Aug. 22, 1906.

This invention relates to kilns and ovens for burning pottery and performing analogous operations, of the type in which Mond gas or other producer gas is used as the fuel, and a system of gas and air flues or passages are employed for conveying the fuel and atmospheric air as a combustible mixture to the oven or chamber in which the goods to be burnt or fired are contained. The object of the invention is to provide a kiln in which the gas and air flues or passages are arranged in such a manner as "to ensure the utilization of the gas fuel to its maximum calorific value and of the delivery of the atmospheric air to the combustion chamber in a highly-heated condition, in which it will ensure and promote the perfect combustion of the fuel and the development of a temperature and calorific efficiency which are considerably higher than can be obtained when working with gas fuel in kilns of the ordinary construction."

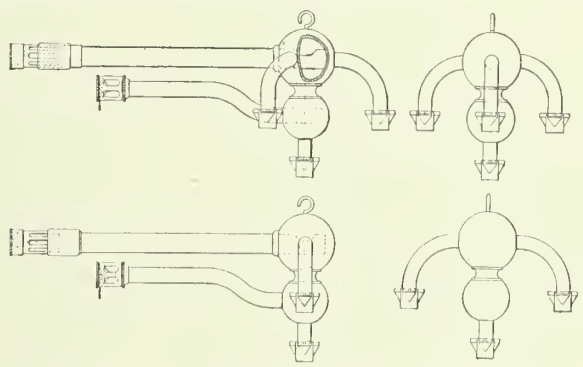
These objects are attained by constructing, within the interior of the oven or firing chamber of the kiln, a plurality of extended or elongated gas and air flues or passages, which communicate with the combustion spaces of the structure and are directly subjected to the heat generated within the oven by the combustion of the mixture of gas and air. Thus part of the heat of the oven is utilized regeneratively for raising the gas fuel and air supplies to a high temperature before they enter the parts of the structure in which they intermingle and are burnt. In this way the complete combustion of the gaseous mixture is said to be ensured, together with the utilization of the fuel to its maximum calorific efficiency and the consequent development of considerably increased temperatures as compared with those obtainable in ordinary gas-fired kilns. Thus the operations which the kiln is designed to perform can be more expeditiously and economically carried out, in addition to which the construction admits of the working of the oven being more easily regulated or controlled.

No less than eight sheets of drawings are required to illustrate the arrangement claimed for the purposes set forth.

Grouping Arrangement for Inverted Burners.

Morton, F. & C., of Manchester.
No. 22,068; Oct. 6, 1906.

This invention is particularly adapted for use in street and other public lighting where the full light is not always required, as some of the lights can be extinguished without affecting (say) one of the burners, and the heat from one burner is utilized to raise the temperature of the gas before it reaches the other burners of the group. All the burners except one are fed from the same supply pipe, which admits the gas and air into a chamber into which curved branch pipes are fitted—one for each inverted burner. There is a second supply pipe for an additional inverted burner, which is preferably in the centre of, but below, the group of burners, so that when all the burners are lighted the heat from the single bottom burner acting upon the chamber heats it and the mixture of gas and air in it.



Morton's Inverted Burner Grouping Arrangements.

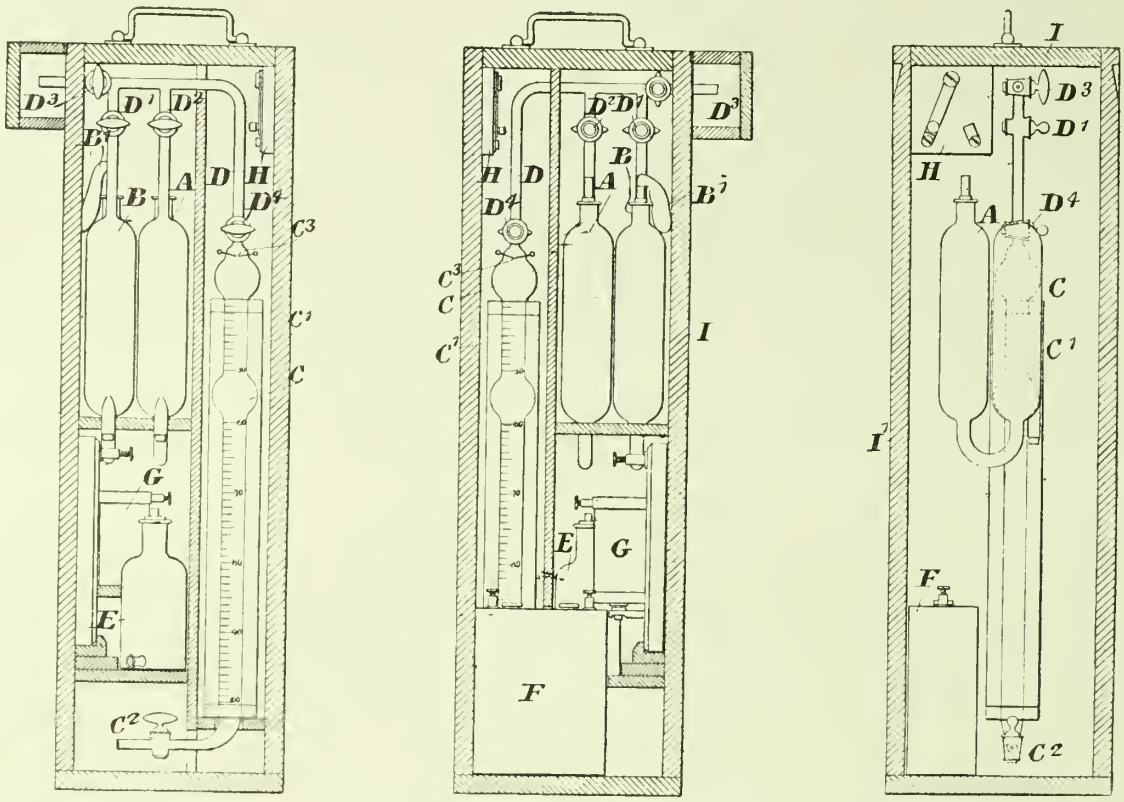
In the first arrangement shown, when all the burners are lighted the heat from the single bottom burner impinging upon the lower globular chamber heats it and the chamber above, and the gaseous mixture they contain is also heated, which "will cause the mixture consumed by all burners to burn with greater heat—thus giving a more brilliant light." Either the group of burners can be turned off by a single tap, or the single burner alone turned off and the group allowed to burn. The second arrangement differs only from the first one in that there are only two (in place of three) burners connected to the upper globular chamber of the main supply pipe.

Portable Gas-Analysis Apparatus.

South Staffordshire Mond Gas (Power and Heating) Company, and Pinnock, H. T., of Dudley Port.
No. 24,405; Nov. 1, 1906.

This invention relates to apparatus of the Orsat type for the analysis of complex gases such as are employed for power, heating, and lighting purposes.

With the ordinary forms and modifications of the Orsat apparatus, the patentees point out that it is necessary to provide an absorption pipette or tube for each of the constituents to be estimated. The apparatus is, in consequence, bulky. An accurate estimation of methane in gases is, moreover, impossible, for the reason that no reagent capable of absorbing methane is known. Further, the use of heated



Pinnock's Portable Gas-Analysis Apparatus.

palladinized asbestos for the absorption of hydrogen is unsatisfactory, on account not only of the slowness of the operation, but also the frequency with which the tubes containing the preparation break when heated to bring about the required reaction. In apparatus intended for estimating carbon dioxide, carbon monoxide, and hydrogen in, more especially, flue gases, it has been proposed to employ a combustion pipette in conjunction with an absorption pipette and a measuring tube. The latter has also been formed with an enlarged graduated part at its upper end.

The object of the present invention is to construct a compact and convenient portable apparatus by which a complete analysis for the chief constituents of producer, illuminating, and other complex gases can be rapidly performed with sufficient accuracy. The invention comprises essentially the employment, in conjunction with absorption pipettes containing suitable reagents for the gases, of a graduated eudiometer or combined measuring and explosion tube with electrical ignition apparatus, whereby such constituents as carbonic oxide, hydrogen, and methane can be readily exploded with air to form carbon dioxide and water, so that the estimation of the various constituents from the data obtained can be effected.

The illustrations show sectional front, rear, and side elevations of the analysis apparatus referred to.

For the estimation of carbonic oxide, carbon dioxide, methane, hydrogen, oxygen, and nitrogen, a pair of absorption pipettes A and B are made from glass similar in construction to those generally employed in the ordinary forms of gas-analysis apparatus—each pipette consisting of a pair of bulbs connected together by a tube at their lower extremities. One of the pipettes (A) contains a solution of caustic potash or soda for the absorption of carbon dioxide; while the other (B) contains alkaline potassium pyrogallate for the absorption of oxygen. To prevent access of air into the rear member of pipette B, and consequent deterioration of the reagent, a flexible indiarubber sac B^1 is provided at the outlet end; the sac being sufficiently thin to readily expand when air is displaced into it during the operation of the apparatus. The rear member of the pipette A is open to the atmosphere.

In conjunction with the pipettes is arranged a graduated eudiometer or combined measuring and explosion tube C, which communicates at its upper end with a main capillary tube D, having tap-controlled capillary branches D^1 D^2 connected with one of the bulbs of each of the pipettes. The outer end of the main capillary tube D may be provided with means for filtering the gas to be analyzed, and also with a tap D^3, by which the supply of gas can be regulated. Immediately above the eudiometer is arranged a three-way tap D^4, to put either the main capillary tube D or the eudiometer into communication with the atmosphere, as well as the several parts into communication with each other. The eudiometer is graduated to measure 100 c.c.; but as all the graduations are not utilized in practice—namely, for example, those between 0 and 20, and 30 and 60—the capacity of the tube is enlarged between these limits by the formation of bulbs thereon as shown, with the result that the total length of the tube is considerably reduced. Advantage in portability is thus gained. The whole of the eudiometer is enclosed in a glass tube C^1 forming a water jacket, to prevent any heating of the gas and the consequent introduction of errors. At the lower extremity of the eudiometer communication is made by a flexible tube (not shown) with an ordinary water-bottle E, which can be raised or lowered as required for effecting adjustment of the water level in the eudiometer or for entirely displacing the gaseous contents from it. The water in the bottle is preferably acidified slightly to prevent the absorption of carbon dioxide, and is coloured with methyl orange, litmus, or other suitable colouring medium. At the lower extremity of the eudiometer a tap C^2 is provided. For producing a spark across the platinum poles C^3 of the eudiometer, a secondary battery F and induction coil G are employed; the circuit being controlled by a switch H. The whole of the parts are compactly arranged within a case I (preferably provided with sliding lids I^1), so that it can be carried about for performing analyses at any part of a gas distributing main or district.

An analysis of (say) Mond gas, by means of the apparatus, is performed as follows: After the main capillary tube D has been swept clear of air by a current of the gas to be analyzed, the eudiometer C is charged in the ordinary manner with 100 c.c. at the normal pressure of the atmosphere. The gaseous contents of the eudiometer are then displaced (by elevating the water bottle) into the pipette containing caustic potash solution, where the carbon dioxide is absorbed. On lowering the water bottle, the residual gas returns to the eudiometer. The difference between the reading of the water level in the eudiometer taken before and after this absorption gives the volume per cent. of carbon dioxide present in the original gas. For the estimation of oxygen, the gas is displayed from the eudiometer into the pipette containing alkaline pyrogallate and then returned. As the gases to be analyzed do not ordinarily contain free oxygen, the readings taken before and after this operation will usually be identical.

The gas remaining in the eudiometer may contain carbonic oxide, hydrogen, methane, and nitrogen. Before estimating the proportions of these constituents, two-thirds of the volume of the gas is discharged to the atmosphere. Air is then drawn into the eudiometer, and the volume noted. Intimate mixture of the air and gas may be ensured by discharging the whole into the caustic potash pipette and returning it to the eudiometer. After closing the taps at each end of the eudiometer, the contents are exploded. On then opening the bottom tap, and re-adjusting the water level in the eudiometer, the volume of the residual contents is noted. The carbon dioxide and excess of oxygen are then separately absorbed, and the remaining volume measured after each operation. The gas finally left in the eudiometer is nitrogen, which consists of one-third of the nitrogen in the original gas together with the whole of the nitrogen in the added air. As the volume of air introduced prior to the explosion is known, the quantity of nitrogen can be readily ascertained by reference to a suitable table.

If N = residual nitrogen
N^1 = nitrogen in added air;
then $3(N - N^1)$ = percentage of nitrogen in the original gas.

To calculate the volumes of methane, hydrogen, and carbonic oxide, let

A = volume of gas taken for explosion
A^1 = combined volumes of CO, CH_4 and H_2
then $A^1 = A - n$ where n is the amount (previously ascertained) of nitrogen in one-third of the original gas.
D = CO_2 formed by the explosion.
C = contraction on explosion.
then $3(A^1 - D) = H_2$ per cent. in original volume of gas.
$3A^1 + D - 2C = CO$ ditto.
and $2C + 2D - 3A^1 = CH_4$ ditto.

The formulæ are deduced from the known theoretical relations between the respective volumes of the original gases and the explosion products.

As an example, the following shows the results obtained in an analysis of Mond gas:—

	Cubic Centimetres.	Per Cent.
Volume of gas taken	100	
,, after absorption by KOH	82·2	∴ CO_2 = 17·8
,, after absorption by pyrogallate	82·2	∴ O_2 = 0·0
One-third of last volume	27·4	
Volume after adding air	96·2	
,, after explosion	78·8	
,, after absorbing CO_2	75·0	
,, after absorbing O_2	68·6	

From the foregoing figures

Volume of residual N_2	68·6	
,, of air added	68·8	
,, of N_2 in air added	54·3	(by reference to tables)
Therefore N_2 present in One-third of original gas	14·3	whence $N_2 = 42·9$ p.c.
Combined volumes of CO, CH_4, and H_2 in 27·4 c.c. of original gas	13·1	= A
Contraction	17·4	= C
CO_2 formed by explosion	3·8	= D

Upon substituting these values of A^1, C, D, in the above formulæ, it will be found that

H_2 = 27·9 per cent.
CO = 8·3 ,,
CH_4 = 3·1 ,,

The result of the complete analysis is therefore—

CO_2	17·8
O_2	0·0
CO	8·3
H_2	27·9
CH_4	3·1
N_2	42·9
	100·0

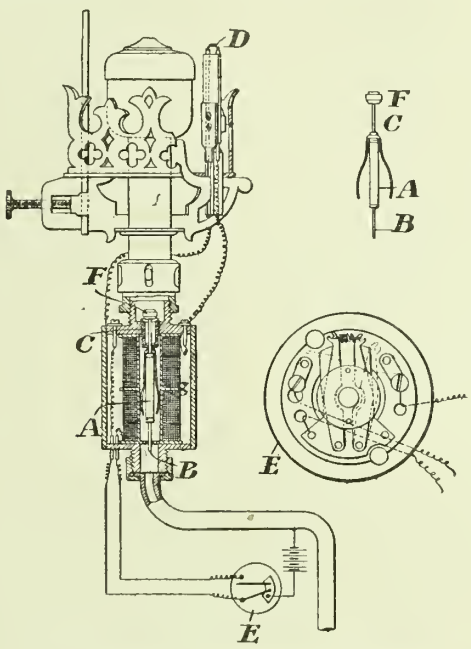
In the case of illuminating gases, a third pipette—containing bromine water or fuming sulphuric acid or other suitable absorbent—is employed for absorbing the olefines and benzenes.

Lighting and Extinguishing Gas-Burners from a Distance.

Clerc, E., and Bidault, E., of Paris.

No. 134; Jan. 2, 1907. Date claimed under International Convention, Jan. 2, 1906.

This lighting and extinguishing device consists of a two-way switch worked as shown.



Clerc and Bidault's Lamp Lighter and Extinguisher.

The bunsen tube of the burner is screwed on a tube intended to admit gas to the mixing-chamber. The tube is provided with a flange connected to a flange made in one piece with a hollow cylinder on which are wound two coils superposed and separated by a flange made integral with the cylinder. The lower flange of the latter carries a plate made integral with a screw-threaded tube intended to be connected to an ordinary gas-duct.

Inside the cylinder carrying the coils, a shuttle or core A, made of soft iron, and provided at its ends with two copper washers, is adapted to reciprocate axially—the core being guided in its motions on the one hand by a rod B secured to it and adapted to slide in an opening arranged in the centre of a cross-piece arranged in the lower opening of the cylinder, and, on the other hand, by means of springs secured by one of their ends to the core, and intended to keep the core in any position into which it may have been moved, as hereafter described.

The core carries at the end opposed to that whereto the rod B is secured, another rod C, provided with a valve F, which (according to the position of the core) closes the passage of the gas or allows it to reach the burner when light is required.

The igniter (arranged upon the burner) comprises a platinum wire D mounted on two rods made of silver or any other metal, and insulated from each other. They are protected from the flame of the bunsen burner by a mica plate connected by an insulating support made of fibre, through which the rods pass and which is carried by a clip secured to one of the arms of the burner-gallery. The platinum wire is arranged at the level of the burner-mouth, and inside the mantle, when applied to an incandescent burner.

The electric current is conveyed to the igniter by two supple wires connected to the rods by points penetrating into holes formed in the lower ends of the rods. The electrical circuit intended to produce the lighting or extinction (the current may come from any source of supply) is diagrammatically shown.

The current, owing to a two-way switch E arranged on the conductor coming from the battery, arrives at the lamp by one or other terminal. The two-way switch, which is the characteristic feature of the invention, comprises two arms, each of which is movable on a pivot situated at one of its ends. These arms have at their opposite ends hooks receiving a coiled spring connecting the ends, and which has a tendency to draw the two arms to the centre of the switch. A pin mounted on the switch-base stops each arm in the direction opposite to that in which it acts. The actuating button of the switch is mounted free in the centre of the latter, and carries a pin which pushes one of the arms in the direction it is intended to give to the current. This arm impinges against a contact which leads the current to the lighting and extinguishing device. After each manipulation, the button is carried back into its inoperative position by the arm itself under the action of the coil spring.

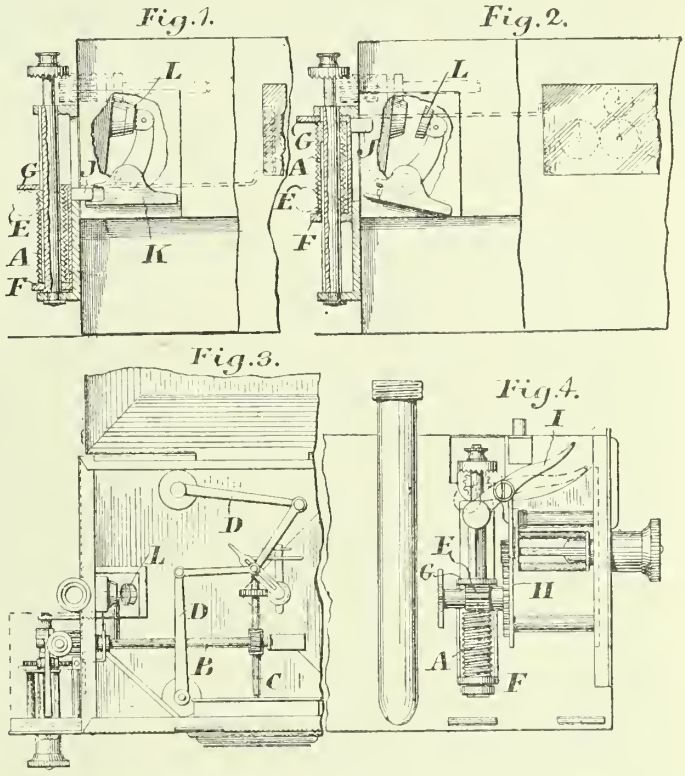
When it is desired to light the burner, the current causes the platinum wire to glow and acts upon the upper coil, which, by attraction, causes the core to rise. It follows therefrom that the valve F leaves its seat and allows the passage of the gas, which, after having been mixed with air in the bunsen burner, is lighted at the igniter. When it is desired to extinguish the burner, the current is made to pass through the lower solenoid; and the core is attracted towards the bottom and carries with it the valve F, which cuts off the admission of the gas to the bunsen burner and thereby extinguishes it.

Coin-Controlled Gas-Meters.

Cuttell, T. L., and the Anti-Vibration Incandescent Lighting Company, Limited, of Otley.

No. 4483; Feb. 23, 1907.

This invention refers to coin-controlled gas-meters in which there is a worm mounted upon, and engaging, a revoluble shaft by a feather and groove, so that at one time the worm can be traversed along the shaft without revolving, by means of a toothed wheel engaging the thread of the worm, which serves at that time as a rack—the toothed wheel being revolved through a definite distance by the aid of an inserted coin; while, on the other hand, the worm-shaft is returned to position by being revolved by mechanism receiving motion from the meter-measuring apparatus, the toothed wheel (then stationary) acting as a nut. The traversing movement of the worm upon its shaft operates the gas-inlet valve to the meter; while in some cases the traversing movement of the worm is also utilized to close the coin-shoot, to prevent the entry of coins when the worm has reached the extent of its motion, and to indicate the number of coins inserted.



Cuttell's Coin-Controlled Gas-Meter.

Fig. 1 is a sectional front elevation showing the gas-valve closed and the worm in its lowest position. Fig. 2 is a similar view showing the gas-valve open and the worm in its high position. Fig. 3 is a plan view with the cover removed. Fig. 4 is a side elevation with the cover of the coin mechanism removed and illustrating the slot-closing balanced lever, the worm, its carriage, and the coin-cage.

The worm A is mounted, as usual, upon a vertical revoluble spindle, which it engages by a groove and feather, so that the worm can be slid in the direction of the axis of the shaft and at the same time can be revolved with the shaft. At the upper end of the shaft is a crown-wheel gearing with a pinion on a shaft B, which carries a worm-wheel engaging a worm on a shaft C, which is revolved by a worm on a vertical shaft receiving motion from arms and links D, operated by the moving parts of the meter. Thus, as the gas is delivered, the worm A, engaging a then stationary toothed wheel E, is slowly traversed down the shaft to its lowest position.

There is a worm and carriage having lower and upper arms F G, of such a form that the shaft of worm A passes freely through these arms,

while the upper and lower ends of the worm bear upon the surfaces of the arms; and so the carriage is traversed along with the worm. Such a carriage is formed with the upper arm G projecting away from the shaft; and upon a stationary frame H is pivoted a counter-balanced lever I, so that its lighter end can be moved to come in front of the coin slot and prevent the entrance of a coin. The position of the extension of the upper arm of the worm carriage relatively to the lever I is such that, when the carriage is about reaching its uppermost position, it tilts the lever against the action of the counterbalance weight and causes its opposite end to prevent the entrance of a coin by the slot; while when the worm is lowered (and with it the carriage), the lever is freed and the counterweight tilts the lever and frees the coin slot. This construction and arrangement of parts, it is said, provides "a very simple and particularly reliable means for preventing the entrance of a coin at improper times."

Beyond this, the rear vertical face of the worm carriage is formed at its upper part with a projection J entering a slot in the casing of the meter, and of such length that, when the worm is in its lower position, the projection passes into the forked end of a rocker K fixed on the axis of an arm which carries a valve L controlling the gas-inlet passage. The fork of the rocker is so fashioned that, when the worm carriage commences its upward movement from the position shown in fig. 1, its projection J will positively act on the upper member of the fork of the rocker and start the opening of the valve, and then the projection, during its further upward movement, passes away from the fork (as shown at fig. 2). Thus the first movement of the valve will not depend merely upon the fact that the end of the rocker opposite to the fork is of greater weight; and so the opening of the valve is commenced by a definite mechanical action, and its further opening is effected by the counterbalancing action of the rocker.

From the worm carriage there proceeds an arm (shown by dotted lines), which indicates upon an index, as usual, the number of coins that have been inserted.

The stationary frame H carries a horizontal revoluble cage, the distance apart of its two end plates (which carry the bars) being sufficient to allow the coin of the predetermined size to enter; and passing through a tubular outer bearing of the cage is a spindle having on its inner end, and protruding within the cage, a stud, which is formed with a slot, so that, upon the coin being inserted in the coin-slot, it is guided and falls between the bars of the cage and enters a slot in the stud, so that the coin is held between the stud and the opposite end of the cage. The stud spindle carries exteriorly an operating knob capable of being rotated, so that, the coin being in the position stated, the knob can be turned through the limited distance allowed, and the coin engaging the bars of the cage give the same angular rotation to the cage, and then the coin is free to fall into the box. As the gas is used and the measuring mechanism operates the shaft B, the worm will descend from the position shown at fig. 2, allow the lever I to move by gravity away from the coin-slot, and finally the projection J of the worm carriage will engage the fork of the rocker and mechanically close the inlet valve.

Igniting Gaseous Mixtures by Electric Sparks.

Marks, E. C. R.; a communication from Aktiengesellschaft für Automatische Zund und Losch Apparate, of Zurich, Switzerland.

No. 1201; Jan. 16, 1907.

This invention has for its object to ensure ignition by constantly altering the course of the sparks, or the size or shape of the gas current, so that the igniting sparks will always pierce through the combustible layer of an air and gas mixture.

It is well known, the patentees remark, that the gas escaping from a burner cannot be ignited by electric sparks if the electric discharge takes place wholly within the gas current. This may be partly due to the fact that the slightly increased conductivity of the gas will offer less resistance to the sparks than pure air, and therefore the temperature necessary for ignition is not reached; and so it happens that the sparks produced with the same apparatus appear white-hot and strong in pure air, and in a gas-current red hot and weak. On the other hand, an ignition will always be effected if the sparks pass from the atmosphere through the zone of ignition into the gas current—the zone of ignition comprising the outer layers of the current of gas, which, together with the surrounding atmospheric air, give a combustible mixture of gas and air. Furthermore, from the fact that white and strong sparks jumping from the atmosphere into the current of gas appear red and weak after passing the zone of ignition, it also follows that the temperature of the sparks is greatest in the zone of ignition, and that ignition is here most likely to happen.

The modes described for carrying out the invention refer to the automatic ignition of gas-flames in street-lamps by means of electric sparks at certain periods produced by the induction machine. For this mode of application to incandescent burners, the igniting flame must be extinguished after the principal flame is lit. It must be at least 60 to 80 mm. long, and from 6 to 8 mm. thick, so that it will remove the cold air from the glass chimney of the principal burner before the ignition takes place—thus preventing an explosion or flashing-back of the flame. So great a length of the igniting flame, however, causes the gas current to be particularly affected by outer influences, thus tending to alter the position of the zone of ignition.

In figs. 1 to 5, some examples of the effects of these influences are given. Fig. 1 shows the shape of the current of the gas at normal pressure, without any external influences. Fig. 2 shows the same current of gas at an insufficient pressure. Fig. 3 shows the current distributed by vibration of the atmosphere due to a sound, an explosion, or the like. Figs. 4 and 5 show a gas stream impinged upon by an air current.

Supposing that provision has been made either so that the ignition sparks will follow the course $x—y$, or that they will move in the direction $x—z$, then, according to the examples of figs. 2 and 4, the course of the sparks $x—y$, and in figs. 1 and 5 the course $x—z$, will have no effect. In fig. 3, with a depressed current of gas the course $x—y$, and with an elongated current the distance $x—z$ will be ineffective. Therefore neither the course $x—y$ nor the course $x—z$ will alone give sufficient guarantee for a never-failing ignition. If, however, the point of issue of the ignition sparks—for instance, the point x—is made movable in such a manner that the sparks will alternately jump to y and z, some of them will not miss the zone of ignition, and consequently will always cause an ignition.

The same effect may also be obtained by regularly altering the direction of the gas current—for instance, by moving the distributing cone up and down; since then also the zone of ignition is sure to be struck by the ignition sparks. A like result is obtained if the course of the sparks $x\,y$ or $x\,z$ were extended beyond the extreme limits of the gas current. This, however, is not correct, since under the present circumstances, a distance between the tops exceeding 4 mm. is not permissible; for in the first place the power of an expanded spring used for driving the inductive machine and the means for cutting off the gas is very limited, since there is very little space available for arranging the spring and the clockwork releasing it at certain periods in order to have as little shadow as possible, and since the period for running the clockwork (on account of the winding to be effected, together with the cleaning of the lamp) must not be less than fourteen days. On the other hand, a great amount of the driving force must be used for saturating the electric sparks (increasing their energy with a given spark length), so that with each ignition the inductive machine must be working for at least ten or twelve seconds. It has been found from

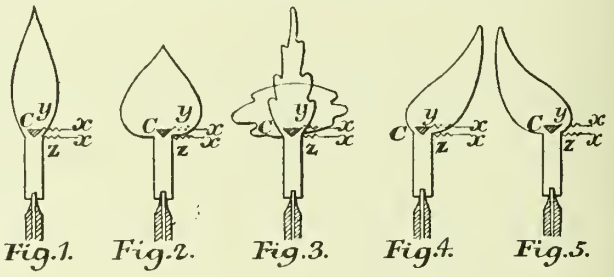


Fig.1. Fig.2. Fig.3. Fig.4. Fig.5.

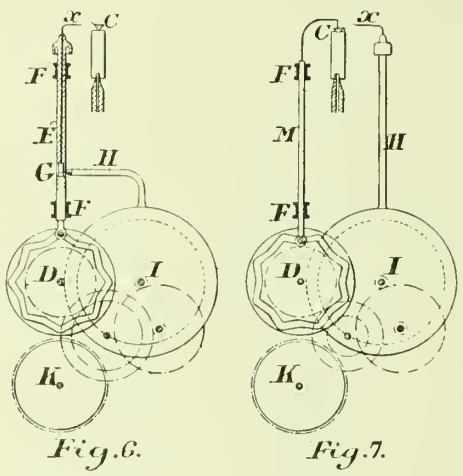


Fig.6. Fig.7.

A Zurich Electric Gas Lighter.

experience that for ignition purposes only sparks saturated up to 100 per cent.—that is, sparks, the energy of which has reached a maximum with a given spark length—are to be used. Therefore saturated sparks which are only 4 mm. long must be produced from sparks of 8 mm. length, which are weak, by means of a condenser, in which case the strength of the driving spring best adapted for the present purpose will be just sufficient. Finally, it must be remembered that, with a greater distance between the points, the tension of the current will be increased accordingly, and that then, with more than 80 per cent. of moisture in the air, the leakage will become very great, whereby the number of the sparks passing over per unit of time is decreased considerably, which will then again make an ignition doubtful.

A movement of the point of issue x of the sparks, or of the distributing cone C, may (for instance) be effected by a cam D (compare figs. 6 and 7), which, in the same manner as the induction machine I, is rotated by a driving spring K periodically released by clockwork. In the former case (fig. 6), the cam disc D moves an insulated rod E, provided with the discharging point x, and connected with the insulated wire H by the sliding contact G; and in the latter case (fig. 7), the disc reciprocates a rod M, which is not insulated and which carries the distributing cone C in guides F, to and fro or up and down.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Capital Expenditure of Gas Companies and Local Authorities.

Sir,—I am unable to follow you in your exclusion of such Companies as the Gaslight and Coke, South Metropolitan, and Commercial, while retaining on the other side such undertakings as those of Birmingham and Glasgow; nor is it easy to see how this can help you. It is true the capital expenditure of these Companies has been less than the average of all the companies by about £64 per million cubic feet sold; but their exclusion increases the average of the remaining companies from £499 to £527 per million cubic feet sold. Moreover, if the London Companies be taken by themselves, it will be found that their average capital expenditure has been more than double the increased capital indebtedness of the local authorities, which it exceeds by about £247

per million cubic feet sold. It is clear from this that size is by no means a predominating factor in this connection.

Will you allow me to repeat the figures upon which I take my stand? The Board of Trade Returns show that between the years 1882 and 1905 the local authorities included in both returns reduced their average capital indebtedness from £712 to £401 per million cubic feet sold, while during the same period the companies also included in both returns increased their nominal indebtedness from £731 to £840 per million cubic feet sold. Deducting the amounts added by conversion of stock, the capital outlay of the companies works out at the rate of £499 per million cubic feet sold, which compares with an additional capital indebtedness of the local authorities of only £188. These figures can neither be explained away nor controverted; and they should, as already pointed out, be a warning to the companies to keep down their capital expenditure as much as possible, consistent with increase of business.

CHAS. HUNT.

15, *Victoria Street, S.W., July* 25, 1907.

[Mr. Hunt repeats his warning to gas companies, and quotes certain figures, regarding capital expenditure; but we are not disposed to let him escape the sole point that raised this correspondence—that it is unfair, before any body of men inexpert in gas finance, to quote the average figures as to capital per million cubic feet of the local authorities and gas companies mentioned in the Board of Trade returns without fully explaining certain conditions that tend to the widening of the difference between them. In last week's issue, we gave Mr. Hunt a further opening for discussing this point, on his statement in the same issue "that there is but little difference in size between the two classes of undertakings which are thus compared, if measured by average consumption." The 148 local authority undertakings in the 1882 returns are all provincial; we therefore excluded the Metropolitan Companies whose positions are unique, and compared the 148 provincial local authorities with the 348 provincial companies, showing conclusively that there was, in 1882, as there is now, a large preponderance of small provincial companies over the local authority undertakings, the capital expenditure of which small company undertakings must go to swell largely the average capital expenditure per million cubic feet of the companies. Mr. Hunt does not say that this point was not proved by us. He only submits that he is (most gas engineers will not be troubled by the same difficulty) unable to follow us in the exclusion of the three Metropolitan Companies while retaining on the other side Birmingham and Glasgow. The obvious reply to this is that we did not exclude any of the large provincial gas company concerns, such as Liverpool and Sheffield. However, we are in a position now to advance further figures on this point as to incongruity of size, if Mr. Hunt is still dissatisfied with those submitted last week; but we think they have shown him the point, though he is unwilling to admit it. We made a suggestion to our correspondent by which the capital history of 148 local authority undertakings and a similar number of company undertakings (in the returns for 1882) of approximately equal capacity could be compared, but he does not evince any alacrity in entering upon the exercise.—ED. J. G. L.]

North British Association—Commercial Section.

SIR,—In your issue of next week, I hope you will be able to give us a clear leading with reference to this subject. I appreciate to the full the benefits of frequent intercourse with my neighbours, to compare notes as to prices and things of common interest. I am not one who immures himself within his own works; I like to make a weekly visit to some neighbour for this purpose.

Some time ago ten or a dozen like-minded gas managers in the West of Scotland used to have a regular meeting day once a month at a common meeting-house in Glasgow, when we compared notes and entertained ourselves in a modest way at our own charges. But the "trader" soon scented us out, and the pilgrimage degenerated into bowls or billiards. Some recollection of that experience was at the back of my mind in my remarks last Thursday.

The sale of coke I think to be the only thing in which the provincial gas manager can be helped. In this matter, we are entirely at the mercy of Glasgow. The price of Glasgow coke, *plus* the carriage, is the best price that any gas-works in the West of Scotland can obtain. You will see, if this is correct, that we are entirely in the hands of Glasgow in the sale of coke.

I hope these few remarks will give you a light in what you have to say regarding this Commercial Section. To put the matter plainer, if Glasgow associates with the Commercial Section, the Committee may do some good work; but if Glasgow stands off, the meetings will be in vain and fruitful of no good.

J. NAPIER MYERS.

Saltcoats, July 27, 1907.

[We do not appreciate the necessity for further discussing the question of Commercial Sections. They have without doubt proved their utility; and we cannot countenance any suggestion of work of proved value being discouraged because there are a few men who take advantage of the opportunities afforded by the prosecution of that work to carouse. Such men will always find opportunities. Just as reasonable would it be to suggest that all the excellent work of our technical societies should be abandoned on precisely the same ground. We are ever for the maintenance of a high standard of usefulness and conduct; but we cannot align ourselves with those who suggest that utility and good shall be hustled on one side by something less virtuous. The general subject of Commercial Sections has been referred to in our editorial columns on various occasions; and matter of a guiding nature will be found in the "JOURNAL" for Sept. 9 and 16, 1902, March 1, 1904, and Sept. 19 and 26, 1905.—ED. J.G.L.]

Distribution of Gas at Increased Pressure.

SIR,—I fear the "Student" whose letter on the above subject appears in the current number of the "JOURNAL" will be plucked for short-sightedness if he ever sits for an examination. The reply to the question by which he was floored is, of course, that I do not live in the district of the Company with which I am associated as Engineer.

CHARLES CARPENTER.

South Metropolitan Gas Company, July 24, 1907.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills Royal Assented: Brighouse Corporation Bill, Bude Gas Bill, Devonport Corporation Bill, Gas and Water Orders Confirmation Bill (No. 1), Great Yarmouth Water-Works and Lowestoft Water and Gas Bill, Heywood and Middleton Water Board Bill, King's Norton and Northfield Urban District Council Bill, Leeds Corporation Bill, Penrith Urban District Council Bill, Pontypridd Urban District Council Bill, Southend Water Bill, Southport, Birkdale, and West Lancashire Water Board Bill, Tees Valley Water (Consolidation) Bill, Wisbech Water Bill, Worthing Gas Bill.

HOUSE OF COMMONS.

Monday, July 22.

THE GASLIGHT AND COKE COMPANY AND METER-RENTS.

Mr. THORNE asked the President of the Board of Trade whether he was aware that the Public Control Committee of the London County Council had given permission to the Gaslight and Coke Company to reimpose meter-rents, at a cost to the consumers of London of about £60,000 per annum; and whether, in view of the pledge given by the Company that meter-rents, which had been abolished in 1895, should not be reimposed, he intended taking any action in the matter.

Mr. LLOYD-GEORGE: I understand that the London County Council have acquiesced in the proposal of the Gaslight and Coke Company to modify the understanding made with the Council in 1903, so as to permit them to reimpose meter-rents (which were discontinued in 1895), at an estimated cost to consumers of about £60,000 per annum, in lieu of raising the price of gas. This has been done subject to the Company giving an undertaking that the authorized dividend shall in future be calculated as if the price of their gas were 1d. per 1000 cubic feet higher than that actually charged; that the price of gas to the Company's ordinary consumers north of the Thames will not be increased beyond the present price of 2s. 11d. per 1000 cubic feet for a period of one year; and that the annual meter charge for a three-light meter shall not exceed 1s. 8d. per annum. The Company appear to be acting within their statutory powers; and the Board of Trade do not seem to have any authority to intervene. I understand that the Public Control Committee of the London County Council were influenced in their recommendation by the fact that the poorer class of consumers who use automatic meters will not be affected by the change.

Tuesday, July 23.

METROPOLITAN WATER BOARD (CHARGES, &c.) BILL.

On the order for the consideration of the Bill as amended (see *ante*, p. 46),

Sir F. BANBURY moved, as an amendment, the recommittal of the Bill to a Private Bill Committee, on the ground that, having been only before one Joint Committee of both Houses, the evidence of consumers and traders did not receive the consideration it should have had, and would have had if, in the ordinary course, it had gone through a Private Bill Committee in each House. A large increase in the charges for water would be imposed on consumers by the Bill—£100,000 additional in the City alone. In the interest of the smaller consumers especially he made his proposition. If there was a deficit on the Water Board's administration, it should be met by a rate levied over the entire London area.

Sir W. BULL seconded the amendment.

Mr. WATERLOW said the object of the Bill was the equalization of water charges in the County of London. As a matter of fact, it would create a fresh inequality between the areas inside and outside that of the London County Council.

Mr. BURNS said the amendment, if carried, would unquestionably kill the Bill for the year, and the large expenses of promotion would have to be incurred again. Uniformity could only be secured by raising some and reducing other charges; and the Water Board were only carrying out the duty imposed upon them by Parliament. The Water Board were under parliamentary constraint to come with the Bill, which had been thirteen days before a Joint Committee. The Committee were unanimous in passing the Bill; and since then substantial concessions had been made to the trade and manufacturing interests. The Board would meet reasonable demands; and he hoped London would not be exposed to the inconvenience of having the settlement of this question again delayed.

Mr. LONG supported the position taken by the President of the Local Government Board. Any solution of this question of the equalization of charges must, he said, cause dissatisfaction in some direction; and no reconsideration would improve the proposals of the present Bill.

After some further remarks, the amendment was lost, on a division, by 53 to 163.

Mr. FLETCHER moved the insertion of the following clause: "Notwithstanding anything in this Act contained, the water-rates shall continue to be payable according to the annual value of the house or building, or part of a house or building, supplied with water by the Board; and such annual value shall, except within the unions and parishes to which the Valuation (Metropolis) Act, 1869, extends, be determined in accordance with the provisions of section 68 of the Water-Works Clauses Act, 1847, and shall in no case be less than the rateable value according to the poor-rate valuations."

Mr. W. F. D. SMITH, in seconding the amendment, said that to pass this Bill before the Valuation Bill promised for next year was to put the cart before the horse.

Lord R. CECIL said this was a measure of enormous importance, and the House was asked to discuss it after midnight, under circumstances when it was impossible to give it proper consideration. He moved the adjournment of the debate.

Mr. F. E. SMITH seconded the motion.

Mr. BURNS hoped the motion would not be pressed, as the substance of the Bill had been decided. If the debate were adjourned, it would mean considering the Bill at an even later hour some future day.

On a division, the motion was lost by a majority of 65.

Mr. DICKINSON expressed approval of the new clause, and called attention to the fact that it was supported by the London members on both sides of the House.

After further debate,

Mr. BURNS opposed the amendment, and eventually it was rejected by a majority of 37.

Mr. COOPER moved an amendment to transfer from the consumers to the Water Board the cost of laying and maintaining communication-pipes.

Mr. BURNS pointed out that at present the Board could not afford to undertake this additional charge.

Sir W. BULL moved the adjournment of the debate, on the ground that a short conference between the contending parties would lead to a settlement between them of the remaining points of difference.

Mr. WATERLOW seconded the motion; and, it being 2.30 a.m., it was carried.

The following further progress has been made with Bills:—

Lords Bill read a second time and committed: Gas and Water Orders Confirmation Bill (No. 2).

Lords Bills reported: Birkenhead Corporation Water Bill, Broadstairs and St. Peter's Urban District Water Bill, Colne Valley Water Bill, Portishead District Water Bill.

Lords Bills read the third time and passed: Coventry Corporation Water Bill, Sheffield Corporation Bill, Tynemouth Corporation (Water) Bill.

COLNE VALLEY WATER BILL.

House of Commons Committee.—Monday, July 22.

(*Before Mr.* ARTHUR STANLEY, *Chairman, Mr.* GOOCH, *Mr.* PEARSON, *and Mr.* HAWORTH.)

The object of this Bill is to confer further powers on the Colne Valley Water Company for the raising of capital and other purposes.

Mr. HONORATUS LLOYD, K.C., and Mr. SYDNEY HOLLAND appeared for the promoters; Mr. BALFOUR BROWNE, K.C., and Mr. C. C. HUTCHINSON represented the Hertfordshire County Council, who were petitioners against the Bill.

Mr. HONORATUS LLOYD, in opening the case on behalf of the promoters, said the Company were incorporated by an Act of Parliament passed in 1873. By the Act they were given statutory power to supply water; the limits of the district then being the parishes of Bushey, Aldenham, and Elstree, in Hertfordshire, and the parishes of Stanmore, Edgware, Pinner, Harrow-on-the-Hill, Kingsbury, and part of Hendon in the County of Middlesex. They were also authorized to sink a well, to erect a pumping-station at Bushey, and to acquire by agreement a quantity of land not exceeding five acres. The water went through Clark's softening process; and the Company had at all times given an excellent supply of very good quality. In 1885, the Company were authorized to purchase the Harrow Water Company's undertaking; and the limits of the Company were extended so as to include the parish of Harrow. Under this Act the Company were also authorized to acquire, by agreement, an area of land not exceeding 20 acres. In 1894, another Act was passed (the Central Middlesex Water Act), which authorized the Central Middlesex Water Company to transfer to the Colne Valley Company that part of their undertaking which was in the parish of Aldenham and Sudbury. In order to provide for the increasing requirements, they had set about sinking a well, called the Eastbury Pumping-Station. This was being done upon land acquired by agreement under the 1885 Act. The area was one acre. Already a very large sum of money had been spent upon this pumping-station. The well had been sunk to a depth of some 165 feet, but was not yet completed. There was power to go deeper; and they must do so in order to get the necessary water. The Company in their early days had great difficulty in raising money; and for some years no dividend was paid. After this, a small one began to be paid; and as the district increased, it went on until eventually a dividend at the rate of 9½ per cent. was paid—the average from 1873 to the present time coming out at 3¼ to 3½ per cent. In latter years, when the success of the Company became assured, the auction clauses also came into play, with the result that a good deal of capital was raised at very substantial premiums. These premiums had gone into the capital account of the Company, but bore no dividend whatever. The Directors had received no fees for twenty years. After this they were voted, he thought, £50 a year each. This had been increased more recently. The time had now come when the capital of the Company was practically exhausted. He thought there was some £12,000, which was now being issued. By clause 4 of the present Bill they sought power to raise £240,000 as share capital, and by clause 14 one-fourth of this sum (£60,000) by way of borrowing powers—making £300,000 in all. This would enable the Company to carry on their undertaking without going to Parliament again for a period of some fourteen years. When the Bill came before the other House, it was opposed by the Middlesex County Council and by eight local authorities. He thought the main ground of their opposition was that the authorized charges of the Company were too high; that they varied in different parts of the district; and that they ought to be reduced. The varying charges were accounted for by the fact that the Company had subsequently acquired the Harrow Company and a portion of the Central Middlesex Company's undertaking; the Colne Valley Company having one set of charges, the Harrow Company's undertaking another, and the Central Middlesex Company a third set. When the Company were before the House of Lords' Committee, having to face the Middlesex County Council and the eight local authorities mentioned, the result was that terms were arranged that were quite satisfactory to all. A number of clauses were inserted in the Bill after these negotiations in order to give the protection which the local authorities and the County Council desired. The result was a very serious one indeed to the Company, because the provisions mainly were that from Jan. 1, 1909, some alterations and reductions of the charges were to be made which would result in the Company's income being reduced by £3400 a year. Then, again, at the end of December, 1913, a further reduction was to take place, which would have the effect of reducing the Company's income by £1600 a year. When the two reductions came into play, the Company's income would be reduced by no less than £5000 a year. Their then opponents were satisfied; and the eight local authorities and the Middlesex County Council having the assurance that these provisions would be made in the Bill, and seeing the clauses that were inserted, went away perfectly satisfied; and the Bill was passed. Now they were met with another petition—that of the Hertfordshire County Council. They did not petition in the first House at all. Counsel having dealt with this petition, pointed out that, by clause 29 of the Bill, which had been agreed with the Middlesex County Council, provision had been made that the supply should be at the fixed rate of 9d., and that it should include the purposes mentioned in section 37 of the Act of 1847—"For the supply of water to all court-houses and public elementary schools within the limits of supply." So far as the Hertfordshire County Council were concerned, the Company had not the least objection to giving them exactly what had been given to the Middlesex Council.

Mr. BALFOUR BROWNE said if the promoters were going to put in a clause that they were not going to give a supply of water, but would make a guarantee that the Hertfordshire County Council would get a supply of water at that rate, he would be satisfied.

Mr. HONORATUS LLOYD promised to consider the question. At the moment all he desired to say was that section 37 was—"in all the pipes to which any fire-plug shall be fixed, the undertakers shall provide and keep constantly laid on unless prevented by frost, unusual drought, or other unavoidable accidents, or during necessary repairs." This was the obligation he was now under; and the difference was that, in this section, it was to be at a price to be agreed, or, failing agreement, to be settled by the Justices. Now they agreed the price at once.

Mr. BALFOUR BROWNE: For my purposes, it is compellable under the General Act. If you make it compellable to the purposes in the case of court-houses and other things, and give me it at 9d., I am satisfied.

Mr. HONORATUS LLOYD: I have no objection to that at all.

The CHAIRMAN: It is compellable in the case of clause 29 for the Middlesex County Council.

Mr. HONORATUS LLOYD: If my friend thinks it is not sufficient, I will make it sufficient.

Mr. BALFOUR BROWNE pointed out that he did not want to prevent the Company completing any works they had begun.

After a short adjournment, Mr. BALFOUR BROWNE said that they had practically agreed clauses, which would not only satisfy the Hertfordshire County Council but the Commissioner of Works also. One was with regard to the mains in the streets (3 feet below), and the other dealt with the supply to elementary schools and court-houses at 9d., which they had bound themselves to do. The first was the most important clause, because it was the one which was also petitioned against, or mentioned, by the Commissioner of Works. There was to be added to clause 33 of the Bill, as a substantive clause, the following:

> The Company shall not, after the passing of this Act, sink any new well upon, or construct any works for taking or intercepting water from, any lands unless such works and lands are specified in an Act of Parliament. But the provisions of this section shall not apply to the completion of the wells and works at Bushey or Eastbury.

The petitioners thought, and he (Mr. Balfour Browne) was glad to say the Commissioner of Works thought, that it was a strong thing to say that, when the Company had begun the Eastbury Well, they should not be allowed to complete it. He was informed that the Company had also started certain works at Bushey; and if they had begun them, the petitioners thought the Company should be allowed to complete them too. Therefore the restriction would be that they should not use any new work, or anything else which was to take away water from Hertfordshire, unless Parliament sanctioned it.

The CHAIRMAN said the Committee were of opinion that the preamble was proved; and the clauses having been adjusted, the Bill was ordered to be reported.

Water Gas at Wigan.—The Wigan Gas Committee have adopted a report of a Sub-Committee appointed to consider tenders for a carburetted water-gas plant and to visit other towns where such installations are in operation, and have decided to accept the tender of the Economical Gas Apparatus Construction Company, Limited, for the erection of a plant.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Friday, July 26.

(*Before Justices* BRAY *and* A. T. LAWRENCE.)

The King v. Justices of the County of London (ex parte the South Metropolitan Gas Company).

This was a motion against a rule calling upon the Justices to show cause why a writ of *certiorari* should not issue to remove a judgment of the Court of Quarter Sessions for the County of London into the High Court on an appeal by the South Metropolitan Gas Company against their assessment in various districts represented by the different Assessment Committees.*

Mr. HORACE AVORY, K.C., and Mr. TERRELL PAINE appeared for the Justices of the County of London; Mr. CRIPPS, K.C., Mr. HORACE AVORY, K.C., and Mr. COX-SINCLAIR for the Woolwich Assessment Committee; Mr. AVORY and Mr. HARPER for the Bermondsey Assessment Committee; Sir RALPH LITTLER, K.C., and Mr. MARSHALL, K.C., for the Greenwich Assessment Committee; and Mr. DANCKWERTS, K.C., and Mr. RYDE represented the Gas Company.

Mr. HORACE AVORY, in support of the motion, said the only ground upon which the rule was obtained was that one of the Justices who formed the Court was disqualified through interest, and (or) possibility of bias. To put it in a word, the allegation was based on a statement that Mr. Willoughby, who was one of the Justices forming the Court, was the Chairman of the Holborn Assessment Committee, who were not a party to the appeal, and the Gas Company had no property in that district whatever.

Justice BRAY asked for the passages in the affidavit on which the rule was obtained.

Mr. HORACE AVORY said it was the affidavit of Sir George Livesey, which stated the bald facts that the appeal was heard for seven days, and on the last day a unanimous judgment was given by the Court dismissing all the appeals with costs; and that it was not until March 2—the third day of the hearing—that it came to his notice, or to the knowledge of any of the officials, that Mr. Willoughby was the Chairman of a London Assessment Committee. It was not disputed that they learned this on the third day of the hearing; and it was not suggested that, when the fact came to their knowledge, they made any objection to it at all. So that, on the authority of many cases, if there was any ground for this objection, it was waived, as they continued to conduct the appeal before Mr. Willoughby. The objection was not taken until after judgment had been given against them. A party who had an objection of this kind was not entitled to sit by and take the chance of getting a judgment in his favour, and then, when it was against him, raise an objection. But he wished to deal with the matter on broader grounds. His submission was that there was no reason for suggesting any interest, or even possibility of bias—which was not sufficient, by-the-by—on the part of Mr. Willoughby, who was Chairman of an Assessment Committee in some other part of London. What it really amounted to was that because the gentleman was Chairman of an Assessment Committee, he was a person likely to know something about the business being discussed before him. "From inquiries I have since caused to be made during the period of the appeals, the gentleman was, and still is, Chairman of the Holborn Borough Council, and as such must have taken part in revising the valuation list in which the Gaslight and Coke Company were rated in respect of their mains; and the total of the sums at which that Company were rated was specially referred to in the cross-examination of the witnesses by the South Metropolitan Company in their appeal." This went to show that this gentleman had had experience of the rating of gas companies.

Justice BRAY asked whether there were any appeals pending by the Gaslight and Coke Company.

Mr. HORACE AVORY said there were none. Objections were made by that Company against the rating; but reductions were offered by the Committee which satisfied them. Even assuming that the gentleman was Chairman of the Assessment Committee, or that in this position he had judicially decided appeals of another company, it could be no objection to his sitting to adjudicate upon the appeal of the South Metropolitan Company. The only result was to make him a person qualified to deal with such subject-matters. He (Mr. Avory) did not wish to argue the matter further upon general principles, because the very point had been decided in that Court within the last twelve months.

Mr. DANCKWERTS pointed out that he called the attention of Mr. Justice Darling to that decision when the rule was applied for, and the learned Judge said the case ought to be considered on its merits.

Mr. HORACE AVORY said in that case a similar rule had been obtained calling upon the Quarter Sessions of the County of Suffolk to show cause why their judgment should not be returned into Court on the ground that one of the members who heard the appeal was the Chairman of an Assessment Committee in another part of the same county, in which it was suggested that questions as to the rating of sporting rights would shortly come before them. But the Court held that, as a member of the Assessment Committee, he was only interested in having the proper value attached to the property, and the rule was discharged with costs. Mr. Willoughby had made an affidavit in which he said that he had been a Justice of the Peace since 1894; that in 1901 he was appointed a member of the Committee of the Holborn Borough Council, becoming the Chairman in 1904; and that a number of the Justices were selected once a year to consider assessment appeals, and only those having a knowledge of rating were selected. In 1905, he was placed on the rota of Justices, and had sat and heard many appeals—one by the South Metropolitan Gas Company. He had never heard an appeal by the Gaslight and Coke Company, though, as Chairman of the Committee, he had heard objections made by the Company in 1900 when the rate was reduced by £600. From that decision there was no appeal. In 1905, the same Company objected; Mr. Ryde, on their behalf, contending for a valuation which worked out at 10 per cent. on the gross receipts, while the Committee asked for 11 per cent. In the end, the latter view was adopted, which again resulted in a reduction; and from this there was no appeal. At the time of hearing the present appeal, he had entirely forgotten the case of the Gaslight and Coke Company. Then he said (what was quite unnecessary for him to say) that he was not biassed in favour of the Assessment Committee.

Sir RALPH LITTLER said his case was exactly the same. He was not quite disposed to go as far as Mr. Avory had, as he had put on one side the question of waiver. It was well known that if such an objection as the present was to be taken, it must be taken at once. In no case had it been permitted for the person to stand by on the chance of getting a judgment in his favour. There were very few more astute gentlemen than Sir George Livesey; and his principal witness, Mr. Ryde, had actually appeared before Mr. Willoughby at the Assessment Committee. Having cited the cases of the *Queen v. Cumberland Justices* and *Allinson v. General Medical Council*, he submitted that it would be a mischievous thing to hold that, because a gentleman had been on Assessment Committees in one part of London, he was incapacitated from sitting in another place.

Mr. DANCKWERTS remarked that he had seldom heard a case which was said to be so very clear subjected to so much effort to obscure it. If it was so clear, he could not understand why such a large array of Counsel had been brought in on the other side.

Justice BRAY said that the matter was no doubt important.

Mr. DANCKWERTS agreed, but thought his learned friend Mr. Horace Avory was fully competent to deal with it. When the rule was granted, Mr. Justice Darling expressed the opinion that the Suffolk case had no bearing upon the present one; and he would show presently why it had not. Though six Justices took part in the hearing of this appeal, they did not all attend throughout the case—in fact, the Chairman was the only one who was present on all occasions. Mr. Willoughby was there four times.

Mr. HORACE AVORY remarked that the rule was not obtained on that ground.

Mr. DANCKWERTS said the judgment was delivered by the Chairman and two others; the remaining three having disappeared. Though Sir George Livesey was aware on March 2 that Mr. Willoughby was the Chairman of the Assessment Committee, yet he did not know that it was a point on which he could object to his competency. Therefore this was a good answer to the question of waiver. With regard to Mr. Ryde, it was a novelty for him to hear that a person who was present in the capacity of witness was capable of objecting to the constitution of the Court. The Counsel for the Gas Company knew nothing about Mr. Willoughby, so that they were not in a position to consider the matter at all. But what did happen was this: On the second day, Mr. Wallace asked, as Mr. Willoughby could not be there the whole of the next time the Court sat, whether the parties would object to him if he undertook to read the shorthand notes. The parties naturally said they would not object. But when Mr. Willoughby's absence extended to three days, the matter grew different, and things got to such a pass that on the fifth day Mr. Wallace was left in sole possession of the Bench. Then he (Mr. Danckwerts) took the objection that he was not going to submit any more to the case being decided by Justices who were not present, and said it had better be decided by the Chairman alone. However, that was over-ruled, though he did object to Mr. Willoughby sharing in the judgment. Coming to the substantive point, he submitted that this was really a very serious objection. The case was very different from the Suffolk case, as here the county rate was fixed on a basis of its own. It did not matter what was the amount arrived at in any particular Union; and the members of the Assessment Committee being members of an adjoining Union had no bias. Not only was it of the greatest importance that the Courts should be in fact unbiassed, but it was still more important that suitors should believe them to be unbiassed. In the Metropolis, the system was entirely different. Under the Valuation Act of 1849, every occupation throughout the Metropolis was put in one or other of the valuation lists, and by section 45 the list was made conclusive for a number of rates which were spread over the whole of the Metropolis. Among these, for example, was the education rate and the county rate. The result was that any parish in any part of the Metropolis had a direct interest that every other parish should be rated up to its proper limits. This differentiated the present case from the Suffolk one. Mr. Willoughby had a direct interest in seeing that other parishes were rated up to the highest point.

Justice BRAY: So has every ratepayer.

Mr. DANCKWERTS said that as a member of the Borough Council Mr. Willoughby had an interest, or duty, to see that there was no more put upon his borough than could be lawfully put upon it.

Justice BRAY asked whether that was not going too far.

Mr. DANCKWERTS thought not. His next point was that Mr. Willoughby, as a member of the Assessment Committee, was disqualified from sitting; for there was a real possibility of bias, as Mr. Willoughby was alive to the importance of not reducing the assessment. Of course, one way of getting low rates in his own district was to put them up in another, especially when the appellant was a large company such as the South Metropolitan Company, who paid £85,000 in rates.

Justice BRAY asked what interest Mr. Willoughby had other than a pecuniary interest?

Mr. DANCKWERTS replied that, as a member of the Borough Council, he had a duty, and interest, to all his constituents which rendered him liable to the suspicion of bias. Every subject of the realm ought to have the well-assured conviction that when he came into a Court of Justice, there would be no possibility of the judgment being influenced by bias; and this proposition could not be answered in favour of Mr. Willoughby.

Mr. RYDE followed on the same side, and said it was not alleged by the appellants that Mr. Willoughby was consciously biassed in favour of the respondents; but the Company did allege that, in law, he was unconsciously biassed, and any reasonable litigant might suspect him of bias.

* See "JOURNAL," Vol. XCVIII., p. 750.

Justice BRAY asked whether he was open to that charge simply because he was a member of a Borough Council.

Mr. RYDE answered in the affirmative. There was a widespread suspicion among railway and gas companies that they did not get fair treatment at the hands of local authorities in the election of whose members they had no voice.

THE JUDGMENT.

Justice BRAY, in delivering judgment, said the Court were asked to make absolute a rule which had been obtained that a writ of *certiorari* should issue directed to certain parishes to remove into the Court an order made on April 30 dismissing the appeals by the Company against their assessment, upon the ground that one of the Justices was disqualified through "interest" and (or) possibility of bias. Whatever "interest" might mean there, he would first consider the question of pecuniary interest. It was admitted that Mr. Willoughby had no pecuniary interest except as a ratepayer; and Mr. Danckwerts had admitted that he did not proceed upon this ground. Therefore it must be some other "interest" than a pecuniary one on which it was said he was disqualified from acting. Now, what was Mr. Willoughby's position? He was a member of the Holborn Borough Council, and was chosen by the Council as a member of the Assessment Committee, and became the Chairman. He would take the test which was laid down in Allinson's case as the test to be applied to the present, though it went very far indeed, and he was not quite certain himself that he should go that length. Lord Esher there said that any person who took part in the administration of law should not be in such a position that he would be suspected of bias—that it was highly desirable that justice should only be administered by persons who could not be suspected of any improper motives. There were some people whose minds were so perverse that they would suspect without any ground whatever. The man's position must be such as that in substance and fact he could not be suspected—not that any perverse mind could not suspect him, but that he must bear such relation to the matter that he could not reasonably be suspected of being biassed. Now the question which the Court had to consider was whether Mr. Willoughby could be reasonably suspected of being biassed. On what ground? It was said upon the ground that he was a member of the Borough Council. Mr. Danckwerts had stated that every borough council had an interest in the rating of every other parish being as high as it possibly could be, because rates would be to a certain extent diminished thereby. Therefore it was said that a member of the Council must be suspected of being biassed because it was his duty to see that his parish was treated perfectly fairly. This seemed absolutely too remote; and it was rather the ingenious mind of Mr. Danckwerts which had suggested it, than the mind of any reasonable man. That point certainly was not put forward in Sir George Livesey's affidavit as the ground. If one went into such *minutiæ*, it was difficult to see who could not be suspected of being biassed. He did not think it would occur to any reasonable man that, if he was elected to a borough council, it was his duty to put up the rating of other parishes. When the question was put to Mr. Ryde, he answered it by saying that this was a company, and that companies were not allowed to have votes in the election of members of the borough council, which they considered a very great grievance. He did not say that it was not a grievance; but he could not agree in thinking that every borough councillor would do an injustice. If they were to allow these matters to be taken as a suspicion of bias, there would be no end to applications like the present. The question was, in substance and in fact, whether a reasonable person would suspect a man like Mr. Willoughby of bias merely because he was a member of a borough council. This ground clearly failed. Then there was another, and different ground, put forward in the affidavit, though it had not been very much pressed—that it would be his duty to consider objections made by the Gaslight and Coke Company, and therefore he was not fit to sit and deal with this question. That point was entirely disposed of by the Suffolk case. Upon the whole, he was of opinion that the application failed, and that the rule must be discharged.

Justice LAWRENCE said he was of the same opinion. He did not desire in the slightest degree to diminish the stringency of the law which required that every tribunal was to be without interest in the matters in dispute. This was an invariable principle which should be maintained at high-water mark. But the present case did not come within any of the authorities cited. He could not see that there was any interest at all. One had been mentioned—viz., that of a ratepayer. But this had been given up; and the other matters did not seem to come within the meaning of "interest." The only thing that possibly could be suggested was that Mr. Willoughby was a borough councillor, and a member of a different Assessment Committee. But this was too remote. In fact, there was no ground for saying that the possibility of bias existed in the sense of which the law took cognizance. All that could be said of Mr. Willoughby was that he had had large experience in matters of rating, and was of considerable assistance to the Chairman in deciding the present case. Though it was true that companies did not get very sympathetic treatment from local authorities, still this was not a ground for suspecting bias.

The rule was therefore discharged, with costs.

Lord Joicey and Municipal Expenditure.—At the annual meeting of the Newcastle and Gateshead Chamber of Commerce, held last Wednesday in Newcastle, Lord Joicey was elected President in succession to the late Sir Charles Mark Palmer. Addressing the Chamber, Lord Joicey alluded to municipal expenditure, and said that if commercial men could get their capital as easily as municipalities did they would probably see enterprise go very much more quickly than it was doing at present. As time went on, those who supplied the money would watch with a little more jealousy the outpourings of cash for these purposes. Municipal enterprises were apt to become like other concerns not directed by one head. It was difficult to keep down extravagances, and limit expenditure to things which were likely to be profitable, and were actually required. The wider the field and the less the control over that field, the greater was the tendency to spend money without due cause.

GREENWICH POLICE COURT.—Friday, July 26.

(*Before Mr.* CECIL CHAPMAN.)

Lewisham Borough Council v. South Suburban Gas Company.

An Alleged Nuisance—The Disposal of a Gasholder's Tank Water.

The hearing of this case was resumed to-day. It will be remembered the summons was issued, on the application of the Lewisham Borough Council (who were moved to take action by certain inhabitants in the district), against the South Suburban Gas Company for causing effluvia in the manufacture of gas. The proceedings on the first hearing were reported last week.

Mr. A. H. POYSER appeared for the Borough Council; Sir CHARLES MATTHEWS, K.C., for the Company.

Sir CHARLES MATTHEWS now submitted that the proceedings were *ultra vires*. The summons was dated June 21. He thought he should be able to prove clearly that the necessary alterations to the Company's holders were commenced on April 9, and were concluded by May 24; and the section of the Public Health Act of 1891 relating to the matter referred to a nuisance or an alleged nuisance in existence at the time the proceedings were taken.

His WORSHIP: It is a summons for what is in the nature of an existing nuisance.

Sir CHARLES MATTHEWS (proceeding) said the date of the alleged nuisance was April 11, while the summons was June 21. That the alleged nuisance should be in existence at the time of the proceedings was clear from the nature of the wording of the section itself; otherwise a great hardship would be thrown upon the defence.

Mr. POYSER thought this was a misapprehension of the intention of the section of the Act. The section dealt with a penalty for a wrongful act which had been committed by the Gas Company. There was a fine imposed for any particular nuisance caused by them. This was not the section where an order was made to abate a nuisance.

Sir CHARLES MATTHEWS: The proceedings in the Police Court are surely to put an end to anything that exists, and not for a thing that is past.

Mr. POYSER maintained that, if the section was read clearly, it might be deemed to also refer to a past thing, because it said "unless it is shown that such person has used the best practicable means." Continuing (after further discussion), learned Counsel said the moment a nuisance was committed, there was a liability to fine; and he was asking for a fine that day, and not for an order to abate a nuisance.

Sir CHARLES MATTHEWS said the point was before his Worship. But before leaving it, he should like to call attention to sub section 2 of section 21, under which his Worship had certain power. It said: "Provided that the Court may suspend its final determination on condition that the person complained of undertakes to adopt, within a reasonable time, such means as the Court may deem practicable, and order to be carried into effect, for abating the nuisance, or mitigating or preventing the injurious effects of the effluvia." Throughout it ran "to be" a nuisance, and not "to have been" a nuisance.

Mr. *S. Y. Shoubridge*, examined by Sir CHARLES MATTHEWS, said he was Engineer to the defendant Company, and had had some 30 years' experience in the management of gas-works. Owing to the increasing consumption of gas in the district served by his Company, it had become necessary to enlarge two of the holders—Nos. 7 and 8. They were at the present time adding a fourth lift to them; and in order to put the rest-stones in the bottom of the tanks, it was necessary to take out the water. It was originally intended to alter only one of the holders—No. 8—this year; but when they proceeded to pump the water out of the tank, and had reached a depth of about 26 feet, they found the water from the adjacent tank, which was only about 30 feet distant, was finding its way through the bottom of the tank of No. 8. It therefore became necessary to immediately take the water out of No. 7, so as to prevent it suddenly rushing into the other one. The pumping from No. 8 holder began on April 8, and from No. 7 on May 9. The pumping from No. 7 finished on May 22, and from No. 8 on May 24. This completed the work, so far as removing the water from the tank was concerned. The water had been in the tanks in one case for 17 years, and in the other for 26 years. It was impossible to add the fourth lift without taking the water from the tanks. It was drawn out by a steam-pump, and conveyed by a cast-iron pipe into the drain which ran through the works into the sewer. The water was quite clear, and free from any solid impurity. It was strongly impregnated with gas. It had no chemical action whatever; but it was exceedingly difficult to rid it of its gassy impregnation. He had tried various means of robbing it of smell, but had not succeeded. It was neither acid nor alkaline, nor did it contain any sulphuretted hydrogen. It was impossible for Mr. Redgrave (*ante*, p. 257) to have smelt sulphuretted hydrogen passing through the air the distance of his house from the works. It was possible, of course, for the smell of gas to have travelled along the sewers, and to have come out from the ventilator gratings, of which there were two right in front of Mr. Redgrave's house; but it was not possible for the smell of sulphuretted hydrogen to have been carried by the water, as there was no sulphuretted hydrogen in it. He thought the smell from the water that had been so long imprisoned might reach perhaps from 100 to 150 yards from the works; but he could not conceive of there being any smell from it beyond that distance. At the time of receiving the complaints, he had, with several others, been round the roads nearest the works; and they did not detect any smell. In making the alterations to the holders, everything possible was done to ensure that there should be a minimum of effluvia. There was only one way of dealing with water from a holder tank, and that was to pump it out, carry it in a closed pipe into the sewer, and to do it as quickly as possible. That they did in this case. He had no douht that Mr. Furneaux did smell something when passing along the roadway just outside the works. The smell of the holder water was a distinctly gassy one; and it might be disagreeable to some people. It was different from a strong sewer smell, which was a putrid and highly acrid smell. Only two or three days since, he was woke up in the night by

the smell from a sewer-ventilator. His bedroom was filled with the odour. It was a foggy morning. He knew that many other people noticed the smell. An attenuated sewer smell might be very easily mistaken by some people for a gas smell.

[A sample of water from a gasholder tank was here produced. It was clear, and had little smell. Witness stated that the tank from which it was taken had been in use thirty years; and his Worship, on smelling it, remarked that there was nothing offensive about it.]

In further examination, witness spoke to a visit to the works of two Sanitary Inspectors on April 17, and they returned on April 19, accompanied by Dr. Harris, the Medical Officer of Health. He (witness), with his chief foreman, went with Dr. Harris and the Sanitary Inspectors to see the gasholders. He showed them exactly what was being done, and explained that they had been pumping the water out and putting it into the sewers since April 8. At the time they were there, the pump had temporarily stopped. He told Dr. Harris that he knew of no other way of dealing with the water, and asked him if he could suggest any other. He said "No," and added, "Put it into the sewer, but don't put it into the river." They had been putting the water into the sewer from April 8 to 19; and he was anxious to know if Dr. Harris could suggest a better way of dealing with it. Dr. Harris also remarked: "I know you must do this sort of thing; and I want you to do it as quickly as you can, and with as little nuisance as possible." That was what he (witness) did—pumped it into the drain to the sewer as fast as the former could carry it off. Witness also spoke to another visit of the Sanitary Inspectors on May 28—four days after the tanks had been emptied. On this occasion, it was the Medical Officer who had been awakened from his sleep by some nauseous smell. He (Mr. Shoubridge) wished the Sanitary Inspectors to immediately go round the works to see whether they could find anything that could possibly cause smell; and he showed them, by the wind records kept at the works, that the wind at the time Dr. Harris was inconvenienced was blowing away from his house to the works. He told the men to suggest to Dr. Harris that there must be something nearer to his dwelling that caused the smell which he had mistaken for a gas-works smell. The Sanitary Inspectors agreed on that occasion that the smell complained of could not have come from the gas-works. With this exception, there had been no complaint since May 24, when the pumping ended. The smells from the works in 1904 were caused by the removal of the foul lime from the purifier-boxes—lime being then used in the purification of the gas. The Chairman of the Company (Sir George Livesey), through a Bill in Parliament, obtained their release from the obligation to purify by lime. The last of the lime purifiers was emptied on Sept. 24, 1904. Lime had not since been used; so that the smell in the spring of this year could not have been the same as in 1904. Oxide was now solely used; and there was no offensive smell from it, nor a smell that would travel. Mr. Redgrave had suggested that the explanation of the smell was some process of gas enrichment; but they had now abandoned enrichment. Through the lower standard of illuminating power allowed by the Company's last Act, there was no necessity for any enrichment. Regarding Mr. Walter Mason's statement that what caused the smell also produced an oily film on the leaves of plants, this was an entire misapprehension. In proof of this, a number of the other gentlemen who were present—one particularly, Mr. Selfe, who lived much nearer the works—had a splendid show of flowers, growing most luxuriantly, at the present time. Mr. Furneaux had also a splendid garden. At the foot of Mr. Mason's garden was the Sydenham Recreation Ground, where could be seen at any time a fine display of flowers. Two of the most famous nurseries in the kingdom—Messrs. Carter's and Messrs. Laing's—were under ¼ mile from the works; and they had never had complaints from them. He was sure the smell could not have been carried through the atmosphere the distance spoken to by the witnesses; and he could not account for the smells in any other way than that they came up through the sewer gratings. The best practicable means were used for preventing and abating any nuisance; and speaking after an experience of over thirty years, during which he had emptied a great many gasholder tanks, he knew of no other plan that could possibly have been adopted.

Cross-examined: It was impossible for smell from the works to be carried by means of the air so far as Dacres Road. The witnesses at the previous hearing were all highly reputable and excellent gentlemen. He did not dispute that Mr. Furneaux might have noticed a strong smell on passing the works; but he must have carried it in his nose up to his house. He probably noticed a strong smell on passing the works, and, thinking badly of it, no doubt it lingered with him. He (witness) was quite certain of this, that had Mr. Furneaux been coming from his house towards the works, he would not have detected the same smell at his house. Their enrichment process was discontinued in 1906. The process was carburetted water gas; and the storage of the gas might have left a film on the water in the gasholder tank. The gas, however, was stored mixed with coal gas. Questioned as to whether there was not a great deposit from this, both on the water and under the water, he said there was not a great deposit, but he did not say there was no deposit at all. There was just a floating film on the top of the water; and when the water was taken out of the tanks, a filmy deposit was left on the clay bottom. It did not adhere to the side plates of the holder at all, or to the sides of the tank. It simply rested as a thin film on the bottom of the tank. He could give no reason at all why the smell complained of was worse on April 11—the day might have been a very hot one. He had heard the witnesses speak of offensive smells in March; but they could not have been from the tank water. There was nothing in their ordinary operations that could have caused this smell. But it was possible that the smell coming up on the line of the sewers, where the tank water was being put in, might cause people to complain. The filmy deposit on the bottom of the holder tank was not thicker than a sheet of notepaper. The water used in the tanks was river water; and there was a sediment from the river water—the alluvial soil that came down with the river. When the water became quiescent, this settled out, and sank to the bottom of the tank. He could not say whether the sediment was permeated with the smell of the gas the same as the water. The sediment was exposed to the air on the water being pumped out; and it simply dried up on the surface. When the holder was first opened, of course the water would smell stronger than the sample in the bottle, because the water covered a large area—the holder being 150 feet in diameter. Questioned as to whether there was any other process at the works that would produce smell, witness said there was nothing done there that was not done at all gas-works. When coke was quenched with water, a small quantity of sulphuretted hydrogen was liberated. This was a process, however, that was going on day and night in all gas-works; and the smell was not one that could be noticed beyond the confines of the works. He knew men were sent into the sewers at night to clear obstructions, because there was so much water going into them in the daytime that they could not work there.

Re-examined: There had been men working in the holder tanks for some considerable time; there were nearly 100 working there now. He had never heard of any ill-health among the men. Asked whether there was anything coming from the works during the time of the holder alterations other than the smell produced by the tank water, he said there was nothing but the ordinary gas-works smell. If the smell travelled along the sewers, it might be noticed, where there were ventilator openings, possibly a mile away.

Mr. *Charles Carpenter* said he had had to empty several gasholder tanks in the manner described by Mr. Shoubridge; and he thought that was the only way of emptying them. In his opinion, it was the proper treatment to put the water in the drains; he knew of no other means of dealing with it. When the water in the tank was exposed, there was undoubtedly some smell. It was a very characteristic smell; and when once smelt, he did not think it would ever be forgotten. The evidence of Dr. Harris in this respect was correct; it was quite a characteristic smell. The sample of water that had been put in was a fair one of the water ordinarily found in gasholder tanks. To smell it in small quantities, it was not offensive, but in large quantities, such as in the holder tanks, he thought many people would say it was unpleasant—nothing more. To use an illustration. Some perfumes that in small quantities were pleasant, in large quantities were offensive. It was exactly the same with the sample of tank water, which was a truly representative one, and the water in the tank. As to its carrying power, he had emptied several tanks, and had never had any complaint of a smell farther away than 30 or 40 yards. Those who complained most in his experience were the people living in premises backing on to the works where the holders were. He had had to empty several of the gasholder tanks near to the Kennington cricket ground; and it was impossible to smell any of those in passing through the roads in the neighbourhood. The gentleman who at the last hearing said he did notice the smell near the gas-works might have done so; but with the others, he (witness) asserted it was impossible.

His Worship: What I have to find out is, how these gentlemen who complain have come to smell what they have described, and how they have come to be mistaken. They say they can only trace it to the gas-works. I have to find some solution. You have helped me by saying that the smell from the tank water could not have reached the distance. Therefore it must have been something else. I have to find out that "something else."

Examination continued: As to sulphuretted hydrogen, they were troubled with it in the days of lime purification. It was only given off in small quantities in the quenching of coke. He had managed two large works, and had never known any complaints to arise from the quenching of coke. The smell that was given off was much the same as that which arose from the quenching of a fire. It was due to the sulphuretted hydrogen in it. The quantities, however, were so small that the smell was quite local, and disappeared within the confines of the works. There was another reason why this could not have been the cause of the complaints of the gentlemen who gave evidence the previous week. If there had been a sufficient quantity of sulphuretted hydrogen discharged from the works to reach 700 and more yards away, the whole neighbourhood would have been up in arms; for the people residing 700 yards away would only have got (so to speak) the "fag-end" of the sulphuretted hydrogen. He did not think the people in between would have been peaceable under the circumstances. Moreover, the whole of the silver in their houses would have been blackened. Sulphuretted hydrogen in large quantities did deposit not only on plants, but in the roadway, something of an oily naiure; but to do this it had to be present in large quantities—such as would be produced by lime purification. Where the process of purification was by oxide, it would be quite impossible for there to be any such escape of sulphuretted hydrogen. Sulphuretted hydrogen did come from sewers in small quantities; and he believed it was due to the decomposing organic matter. He thought it was perhaps owing to this that those who were accustomed to search for escapes of gas differentiated between the two—coal gas and sewer gas—by reason of the fact that sewer gas produced nausea that did not arise from coal gas. Asked as to what, in his opinion, was the source of the complaint made by the witnesses at the previous hearing, witness said, when he heard their evidence, he could not help thinking of a similar experience of his own in managing a works. The Medical Officer of Health paid him one or two visits, because the House of Commons had been complaining of nauseous smells. The Medical Officer came to his works simply because they were the nearest to the House; but, in the end, it was found that it was the sewage system of the House itself that was defective, and some £11,000 had to be spent in putting it right.

Sir Charles Matthews: What in your opinion was the justifiable source of the complaint of these gentlemen?

Witness: That is a difficult question. I can only tel' you that, in my opinion, it was not the gas-works. I visited the works in December last, and spent several hours there. The manufacturing operations were then in full swing. I went there again a fortnight ago, when things were quieter. They are admirably conducted works.

Cross-examined: He had not had experience with the manufacture of carburetted water gas as carried out at Sydenham; but he had with enrichment by oil. He knew there was a deposit produced by carburetted water gas on the tank water; but he did not agree with the suggestion as to there being any pungent smell. Anyone who was working where there was sulphuretted hydrogen would be glad to go to water gas as a relief. As to water gas being a nuisance, its manufacture was carried on in most corporation gas-works in the country; and he did not think they would carry on a nuisance. Any smell that

was produced would be diffused long before it reached such a distance as the Dacres Road. As to the film of deposit at the bottom of the gasholder tank, he had not smelt it from the top of the tank. There might be a little reek rising from it; and he daresay if one put his head over the tank that he would be conscious he was not looking into a water-works reservoir, but into a gasholder tank. This, however, could not have caused the smell in Dacres Road. They would have to pay their men double money if the thing was so bad as that. The smell in Dacres Road might have come from the sewers.

Mr. POYSER: I suggest to you that this film as it has been called—or the sediment I would rather call it—was the cause of the smell?

Witness replied in the negative. He thought there had been a little confusion over the film and the sediment. There would be no film on the top of the water other than an immeasurably thin one—as thin as a sheet of note paper it had been said, but it would be much thinner than that. Nothing more would be resting on the surface of the tank. No water-gas enrichment had been going on at these works for some months; and therefore any oily matter would have been volatilized, and have gone forward with the gas. That disposed of the film. On the bottom of the tank there would have been a little settlement of naphthalene. This deposit looked about ¼ inch thick; it might have been less. He believed that ½ gallon would have produced the film over the whole of the tank; it was so thin.

There was some discussion at this point as to a further adjournment. In the course of it,

His WORSHIP said that the impression made upon him by the gentlemen who had given evidence the previous week was that there had been a nuisance which, although it had been scotched, had not been killed, and which, by a little more pressure, might be completely destroyed. This was his first impression, but he could not reconcile it now with the evidence of the Company's witnesses. Any impression there was had been relaxed. Later on, he asked if there was no possibility of tracing the nuisance to any particular cause. At the present, he should say the smell had nothing whatever to do with the water in the holder tanks. It must be from some other cause. Therefore it seemed to him the cause was not a temporary one; it was something larger than that. What they had to do was to make it impossible for these gentlemen to suffer as they had hitherto suffered.

Sir CHARLES MATTHEWS asked whether it would not be a reasonable thing that the matter should be adjourned (say) for two months; and then during August and September, both parties could be watching very closely for the purpose of seeing where the cause of offence did come from. If they could only discover what the offending cause was, it would be a good way of spending the two months.

His WORSHIP: The case being met as it is by a complete denial on the part of the Company, and a complete assertion of a most definite character by two gas experts that they cannot, by the utmost stretch of imagination, trace this smell to the gas-works, it does seem to me essential that the evidence that has been brought before the Court should be supplemented by people of an expert character who should really find out whether the smell does exist, and whether it does or does not come from the sewers. Personally, from the evidence on the positive side, I think there is no tracing it to the sewers. But it would be a great advantage to the Court, in making up its mind, to have this thing very carefully watched by people engaged for that particular purpose; and as defendants had offered the suggestion that they were willing in these two months to submit themselves to careful examination by experts, it would be a great advantage to everybody, and a good thing.

Mr. TEMPLER DOWN (Solicitor to the Council): The cost of watching will be considerable.

His WORSHIP: Then it will have to be paid by the defendants, if the case goes against them.

Mr. TEMPLER DOWN: I do not think the trouble will occur again in the next two months.

His WORSHIP: That will be evidence that it can be stopped. The case will not be neglected because it is put off, and the defendants will not escape their liabilities.

Mr. POYSER: And we shall be in a position to make a rebutting case.

His WORSHIP: I desire you should be, and that the nuisance should be traced to its source. The defendants will have to pay something besides the fine if it is traced to them. The matter will now be adjourned *sine die;* and a day will be named for a further sitting in about two months' time.

Water Purchase Bill for Skegness.—At a special meeting, the Skegness Urban District Council have decided (with one dissentient) to promote a Bill in Parliament to authorize them to purchase the undertaking of the Skegness Water Company, to make further and better provision with regard to the improvement of the health, local government, and finance of the district, and for other purposes. The Clerk read a report by Mr. W. H. Radford, Consulting Engineer, of Nottingham, who stated that he had carefully inspected the boring and works at Welton, and was of opinion that the water was of good quality and ample quantity. A ratepayers' meeting will be held in November for the purpose of authorizing the scheme, or otherwise.

New Joint-Stock Companies.—The Gowerton and District Gas Company, Limited, has been registered with a capital of £15,000, in £5 shares (£1500 in 7 per cent. preference shares), to adopt an agreement with the Gas and Water Works Supplies and Construction Company, Limited, and to carry on the business of manufacturers and suppliers of gas. The Ludlow Union Gas Company, Limited, with a capital of £5690, in 611 ordinary and 526 preference shares of £5, all taken up and paid in full, is a re-incorporation, with limited liability, of the Ludlow Union Gas Company, originally constituted by Deed of Settlement dated May 29, 1840, and registered as an unlimited Company on May 4, 1874. The Improved Smokeless Coal Company, Limited, has been registered with a capital of £5100, in £1 shares, for the supply of an improved smokeless coal. There will be no initial public issue. The Globe Safety Gas Company, Limited, has been registered with a capital of £15,000, in £1 shares.

THE CHARGES AGAINST MR. GILBERT LITTLE.

An Apology.

At the Smethwick Police Court, last Thursday, a termination was reached of the case in which Mr. Gilbert Little, of the Gilbert Little Company, Limited, of Bradford, was summoned, at the instance of Mr. Henry Peaty, of the New Conveyor Company, Limited, for having on March 13 last, and other dates, unlawfully and maliciously published certain defamatory libels concerning him, and also for feloniously and maliciously sending to him on May 21 a letter demanding with menaces the sum of £872. The complainant succeeded the defendant as Managing-Director of the New Conveyor Company; and the case arose in consequence of a number of letters which had been sent to persons in various parts of the country by the defendant which the complainant alleged were of a libellous character, as they cast serious reflections upon him, while one addressed to himself contained an unlawful menace demanding money. The case was before the Court earlier in the month [see "JOURNAL" for July 16, p. 180], when an adjournment was ordered, so that Mr. Little might attend.

When the case was called on, Mr. Willison, who prosecuted, explained that since the adjournment the defendant had unreservedly placed himself in the hands of his Solicitor. Mr. Sharpe, who appeared for the defence, had seen him (Mr. Willison), and had expressed, on behalf of defendant, his extreme regret for everything that he had done, and had tendered the prosecutor an apology for what had taken place. He had further given an undertaking that no conduct such as that complained of—or for that matter any conduct to which the prosecutor could take exception—should ever happen in future, so far as he could prevent it. The defendant had come forward, and offered to defray the whole of the expenses to which the prosecutor had been put as a result of his conduct. Under these circumstances, the prosecutor had instructed him to come to the Court—believing defendant was prepared to offer an apology, and that he was sincere in his undertakings—and withdraw the proceedings, subject to the consent of the Justices. He therefore proposed to offer no evidence in the case. Defendant would bear all the costs.

On behalf of the defendant, Mr. Sharpe said he was extremely indebted to both the prosecutor and Mr. Willison for the manner in which they had met them. It was a case to which he had given careful and anxious consideration, and he felt convinced from the first—as he told his client when he consulted him—that Mr. Little had done a most unjustifiable action, and had written unjustifiable letters—silly letters—that could not be defended for a moment in any Court. This being the case, the defendant agreed with him, and left himself entirely in his (Mr. Sharpe's) hands. The only thing they could do was to make a complete and unreserved apology for what had taken place, and thank the prosecutor for the manner in which he had met him. He endorsed what had been said by Mr. Willison; and they were prepared to carry out the terms he had mentioned.

After a brief consultation, the Magistrates agreed to the case being withdrawn.

WESTMINSTER COUNTY COURT.—Tuesday, July 16.

(*Before His Honour Judge* WOODFALL *and a Jury.*)

Buck v. Metropolitan Water Board—Liability for Injury through Stopcock-Lids.

This was an action brought by Mr. Walter William Buck, a head schoolmaster in the service of the Willesden District Council, to recover damages for personal injuries caused through his tripping over stopcock-lids in Shakespear Avenue, Stonebridge Park.

Mr. F. M. ABRAHAMS appeared for the plaintiff; Mr. A. B. SHAW represented the defendants.

Mr. ABRAHAMS said the plaintiff claimed with respect to two injuries—the first sustained in November and the second in January. Plaintiff resided in Acton Lane, Harlesden, and he passed along Shakespear Avenue on his way to and from his school. The result of his two falls was that his knee was injured in such a way that his medical man (Dr. Burns Gibson) advised him to go to the hospital to have it attended to; but he went to a bone-setter and obtained relief. Negligence was alleged against the defendants on the ground that the lids covering the stopcocks were not flush with the pavement, but stood up above it. The defendants said they were not liable, as they had done with the lids when they had fixed them; after that the local highway authority—in this case, the Willesden District Council—was responsible for seeing that the highway was safe.

Plaintiff was called, and described how he was tripped up at the same spot on two occasions, and how his injuries were put right. Dr. Burns Gibson and the bone-setter also gave evidence.

Mr. *Haylor*, Assistant-Surveyor to the District Council, stated that this body had nothing to do with the fixing of stopcocks. In Willesden they were put in by the West Middlesex Water Company, and were taken over by the Water Board. The pathway was made up of 4 inches of concrete covered by 3 inches of tar paving. In Shakespear Avenue it was not at all worn down by the stopcocks, neither had it in any way collapsed. Tar paving that had been down in Willesden for twenty years showed no sign of wear.

Mr. *John Cash* said he had examined the tar paving in the neighbourhood of the stopcocks in the avenue, and found no sign of wear or subsidence. In his opinion, they had been fixed without proper care, and at a wrong level.

Other witnesses having deposed to being tripped up by stopcock-lids,

Mr. *Howard Barnard*, one of the managers at the school where plaintiff is engaged, said he complained to the Board about the lids standing up, and in some cases they had been made flush with the pavement. He saw the District Engineer and Superintendent to the Board (Mr. E. C. Barker), who said there was no liability on their part, as it was for the Local Authority to keep the pathway in order.

For the defence, Mr. *Barker* gave evidence to the effect that there was a constant supply of water in the avenue, and that it was necessary to have stopcock boxes, which were always put in so as to be a little below the surface of the path.

Workmen in the employ of the Board gave evidence that the boxes were put in at a level slightly lower than that of the tar paving. The paviors followed the men who put in the boxes.

Wednesday, July 17.

On the resumption of the hearing of the case this morning,

Mr. SHAW submitted that no case had been made out against the defendants, as to either negligence or liability. It was the duty of the District Council to repair anything lawfully in the highway, and the plugs in question were lawfully there. He cited several cases, and the provisions of the Public Health Act, in support of his contention. He said the only point that could be brought against the Board was that the plugs were put down ⅓ inch too high; but, if this was so, the Local Authority had neglected their duty by allowing them to remain for 3¼ years.

Mr. ABRAHAMS interposed by reading section 19 of the West Middlesex Water Act, 1852, in which it was laid down that the water authority must do their work in such a way that the public must be safeguarded, and must be responsible for any accident.

Mr. SHAW contended that it was the duty of the Local Authority to have made this highway level; and there was no proof of any breach of duty on the part of the defendants.

Mr. ABRAHAMS again read the section of the Act of the West Middlesex Water Company, which had been taken over with all their duties and responsibilities, by the defendants. All the witnesses agreed that the highway was in perfect repair, and there was evidence of many accidents in consequence of these protruding boxes. There was evidence that the defendants had knocked down the boxes after the accident; and he submitted that this was an admission of liability.

The Jury returned a verdict for the plaintiff for £67; but judgment was reserved to allow of a legal argument.

Wednesday, July 24.

To-day his Honour heard the arguments of Counsel, and entered judgment for the plaintiff. He would not say whether or not he agreed with the conclusions of the Jury; but they having found that the defendants negligently placed in the highway the obstruction complained of, he granted the plaintiff £67, with costs.

Mr. SHAW asked for a new trial.

His HONOUR said he would not then consider the application, but would do so at a future date if Counsel was instructed to renew it. In order to save expense, he said he might state that he was not disposed to grant a new trial.

Brussels Municipal Gas Supply.

According to the report of the Gas Committee of the Brussels Municipality for the past year, there was a falling off in the consumption of gas. The quantity used in 1905 was 39,986,157 cubic metres, or about 1411½ million cubic feet, whereas last year it was 39,287,099 cubic metres, or rather more than 1386¾ million cubic feet. This is ascribed to the competition of electricity. The receipts were 7,326,090 frs. (£293,044); and the expenses 5,023,455 frs. (£200,938). Reckoning 274,833 frs. for the increase in the value of the stores, the difference in favour of the communal account is 2,577,469 frs. (£103,099). The quantity of coal carbonized was 124,694 metric tons. The expenses of first establishment came to 496,288 frs. (£19,851), comprising the purchase of an elevator for discharging coal, the construction of the foundations of a holder, six purifiers, and various appliances. At the close of the year, the capital account stood at 31,738,175 frs. (£1,269,527). The number of meters increased by 1875, making the total 40,259; and the rising pipes, by 222. There were 471 new installations of gas last year; bringing up the total to 14,993. There are in the city 6776 public lamps, of which 673 are extinguished after midnight.

Public Lighting in South London.

At the meeting of the Lambeth Borough Council last Thursday, the Town Clerk reported that he had sent a letter to the Gaslight and Coke Company in reference to their circular announcing an increase in the price of gas used for public lighting from 2s. 2d. to 2s. 5d. per 1000 cubic feet. He pointed out that the South Metropolitan Gas Company had not raised their price (by which that of the Gaslight and Coke Company is governed); and he asked why, under these circumstances, the advance of 3d. had been made. Replying in the absence of the Secretary (Mr. H. Rayner), the General Manager (Mr. D. Milne Watson) explained that the increased price of gas in the case of certain public lamps within the South Metropolitan Company's district was balanced by a reduction they were enabled to make in the charge for maintenance, which, of course, had no effect on the statutory obligation laid upon the Gaslight and Coke Company to regulate their charge for gas by that of the neighbouring Company. The Lighting Committee reported that they had given directions that efforts should be made to induce the Gaslight and Coke Company to take the same action in regard to street lighting as the South Metropolitan Company had done. On Oct. 11 last year, the Council decided to allow the former Company to experiment for a period of three months with an appliance for automatically lighting and extinguishing the public lamps; and on the 25th of April the time was extended to the 30th of June. The Company's Chief Inspector (Mr. F. W. Goodenough) had written to the effect that other appliances had been brought under their notice, and as these would be considerably cheaper to instal than the system which had been tried and found satisfactory in Lambeth, he should be glad to have a further extension of time till the end of September. This was granted.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY'S ACCOUNTS.

[For the Half-Yearly Report, see p. 301.]

The accounts of the Company for the six months ending June 30, to be submitted with the Directors' report on Friday, consist of the usual statements, from which we take the following particulars.

The statement of capital (stock) sets forth that the total paid up is £9,466,500; added on conversion, £12,176,565—total amount authorized, £21,643,065. Deducting the amount redeemed, £60,610, the total amount of the Company's existing capital powers is £21,582,455. The statement of loan capital stands thus: Total paid up, £2,844,000; added on conversion, £1,479,975; unissued, £750,000—total amount authorized, £5,073,975.

The capital account shows receipts (with premiums, £1,586,807 11s. 9d.) to the amount of £27,493,237 11s. 9d. The expenditure is shown in the following items:—

Expenditure to Dec. 31, 1906			£13,458,626 15 2
Expenditure during the half year to June 30, 1907—viz.,			
Buildings and machinery in extension of works	£4,695 8 7		
New and additional mains and service-pipes	15,051 7 3		
Do. do. meters	21,599 3 3		
Do. do. stoves	12,970 16 4		
	£54,316 15 5		
By depreciation of plant	£25,855 0 7		
By depreciation of meters and stoves	27,589 8 11		
	53,444 9 6		
			872 5 11
Total expenditure			£13,459,493 1 1
Nominal amount added on conversion			13,656,540 0 0
			£27,116,039 1 1
Deduct amount of capital redeemed under Company's Act of 1903 (per previous account, £40,090; this half year, £20,520)			60,610 0 0
			£27,055,429 1 1
Balance of capital account			437,808 10 8
			£27,493,237 11 9

The balance applicable to the redemption fund and to dividend on the ordinary stock is £651,159 6s. 5d.; and the following statement shows how it is proposed to appropriate it.

June, 1906.			
£181,299	..	Net balance brought from last account	£229,952 19 11
373,651	..	Net revenue for the half year	421,206 6 6
£554,950			£651,159 6 5
10,000	..	Contribution to redemption fund	10,000 0 0
(£4 8s. per cent.)		Dividend on the ordinary stock—	
£334,469	..	£4 8s. per cent. per annum on £15,182,590	334,016 19 7
..	..	Forfeitures for deficiency in illuminating power	150 0 0
£210,481	..	Balance carried to next account	£30,992 6 10

The following is the revenue account:—

Expenditure.

June Half Year, 1906.		£ s. d.	£ s. d.
	Manufacture of gas—		
£ 00,940	Coal into store	556,771 0 1	
78,536	Oil ,, less value of oil tar	80,539 12 10	
	Coke and breeze used in the manufacture of carburetted water gas	33,604 6 8	
27,145	Salaries of Engineers and other officers	14,917 1 8	
15,357	Wages, gas making £91,195 0s. 8d.	104,618 10 11	
10 ,030	,, sundries £13,423 10s. 3d.		
16,651	Purification, including £10,892 9s. 6d. for labour	22,624 17 11	
35,402	Repair and maintenance of works and plant, materials and labour, less received for old materials, £10,097 1s. 8d	212,228 4 10	
199,794	Distribution of gas—		1,025,304 4 11
	Salaries and wages of officers (including Rental Clerks)	43,154 16 11	
41,966	Repair and maintenance of mains and service-pipes, &c.	56,891 18 6	
60,280	Repair and renewal of meters	46,468 14 1	
28,927	,, ,, stoves	50,727 12 8	
36,391	Gas fittings, including labour (automatic meter supplies)	29,258 2 10	
..			226,501 5 0
19,691	Public lamps—lighting and repairing	..	19,519 15 3
	Rents, rates, and taxes—		
5,782	Rents payable	5,850 4 4	
144,197	Rates and taxes	136,522 18 7	
	Management—		142,373 2 11
2,750	Directors' allowance	2,750 0 0	
200	Company's Auditors and Assistant	202 2 0	
7,655	Salaries of General Manager, Secretary, Accountant, and clerks	7,911 0 6	
22,770	Collectors and Cashiers	22,880 5 8	
5,073	Stationery and printing	5,337 18 2	
4,427	General charges	4,780 17 7	
			43,862 3 11
664	Parliamentary charges	..	..
1,336	Law charges	..	1,156 14 6
350	Charges *re* quinquennial re-valuations	..	..
5,250	Bad debts	..	5,413 14 7
500	Depreciation fund for works on leasehold lands	..	500 0 0
23,323	Annuities, including contribution to officers' superannuation fund	..	24,378 15 11
1,529	Workmen's compensation account	..	1,321 15 2
	Public officers—		
1,280	Gas Referees and Official Auditor	1,244 17 6	
1,009	Public testing-stations	612 11 7	
			1,857 9 1
£1,397,775			1,492,189 1 3
569,879	Balance carried to net revenue account		628,992 16 3
£1,967,654			2,121,181 17 6

Receipts.

June Half Year, 1906.		£ s. d.	£ s. d.
	Sale of gas—		
	Per meter, at 2s. 11d. and 2s. 2d. per 1000		
£1,480,735	cubic feet	1,520,595 8 7	
68,920	Public lighting and under contracts . .	68,772 10 2	
			1,589,367 18 9
£1,549,655			
37,196	Rental of stoves	..	37,326 1 4
.	Rental of fittings	..	58,545 0 7
	Residual products—		
£211,973	Coke, less £35,647 9s. 8d. for labour, &c..	271,911 13 9	
14,440	Breeze, less £5074 1s. 7d. for ditto . .	13,696 12 8	
50,959	Tar and tar products	47,929 4 9	
	Ammoniacal liquor and sulphate of		
98,578	ammonia.	95,522 2 3	
			429,059 13 5
£375,970			
£4,523	Rents receivable		4,568 5 11
3 0	Transfer fees		314 17 6
£1,967,654			2,121,181 17 6

The three statements relating to the reserve, insurance, and depreciation funds show that the balances on June 30 were as follows: Reserve fund, £63,198 3s.; insurance fund, £94,055 7s. 8d.; and depreciation fund, £64,746 3s. 10d. A sum of £9208 13s. was written off the investment of the insurance fund in the past half year; reducing the cost of Consols to 85 per cent.

The following statements relate to the working:—

Statement of Coals Used, &c.

Description of Coal.	In Store Dec. 31, 1906.	Received During Half Year.	Carbonized During Half Year.	Used During Half Year.	In Store June 30, 1907.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common. . . .	224,740	783,133	876,004	2,134	129,735
Cannel	12,036	..	3,922	..	8,114
Total . . .	236,776	783,133	*879,926	2,134	137,849

* In addition to this quantity of coal, 7,285,106 gallons of oil and 58,441 gallons of spirit were used during the half year.

Statement of Residual Products.

Description.	In Store Dec. 31, 1906.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store June 30, 1907.
Coke—tons	17,378	549,392	111,667	443,004	12,099
Breeze—tons	2,303	74,803	13,640	60,048	3,418
Tar, from coal only—galls.	838,939	8,915,798	9,107,799	17,258	629,680
Ammoniacal liquor—butts	21,763	223,301	230,800	..	14,264

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Total Quantity Accounted for.	Number of Public Lamps.
	Public Lights and Under Contracts. (Estimated.)	Private Lights (per Meter).		
Thousands.	Thousands.	Thousands.	Thousands.	
*12,156,798	465,541	10,749,443	11,360,826	49,000
†11,727,275	468,366	10,394,589	11,001,293	49,699

* Including 2,491,521,000 cubic feet of carburetted water gas. † June half year, 1906.

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, £92,803; oil and petroleum spirit, £36,095; coke, £7485; tar and ammoniacal liquor and products, £79,773; and sundries, £228,173. The figures this time last year were: Coal, £95,193; oil and petroleum spirit, £38,105; coke, £4935; tar and ammoniacal liquor and products, £79,727; and sundries, £250,099.

BRENTFORD GAS COMPANY.

Half-Yearly Report and Accounts.

In the report to be presented by the Directors at the half-yearly meeting next Friday, they state that the sum of £94,539 is available for distribution; and they recommend the declaration of dividends, subject to income-tax, at the rates of 5, 12½, and 9½ per cent. per annum on the preference, consolidated, and new stocks respectively.

The Directors regard with great satisfaction an increase in the quantity of gas sold of 6·7 per cent. over the corresponding period of 1906, as showing considerable elasticity in the business of the Company. The consumers now number 30,323 ordinary and 37,678 automatic, as against 29,734 and 32,831 respectively for June half of 1906. They are also glad to be able to report enhanced receipts for coke and tar. They refer to the great and unexpected loss they sustained by the death, on the 16th of May last, of their esteemed and valued colleague, Mr. Frank Morris, who had been associated with the Company for many years, during ten of which, as a Director, the Board had the benefit of his able advice and intimate knowledge of the Company's district and business. In pursuance of their powers, they elected to fill the vacancy Mr. William King, whose experience and services to the gas industry are widely known. They also call attention to another change in the *personnel* of the Board, owing to the retirement of Mr. Howard Charles Ward from the chairmanship. Mr. Ward had presided over the affairs of the Company for 36 years, and his colleagues notify with the greatest regret his wish to vacate this position. They elected Mr. Ulick Burke to take his place. Meantime the staff of the Company has not been without change. Mr. Husband, after 23 years' service, having expressed a desire to be relieved of his duties as Engineer and Manager, the Directors appointed to that office Mr. Alexander A. Johnston, formerly Engineer of the Ilford Gas Company.

The accounts accompanying the report show that the revenue from the sale of gas amounted to £167,051; from meter and stove rents to £17,176; and from the sale of residual products to £34,313—rents and transfer fees making up a total of £218,580, compared with £201,651 in the corresponding period of 1906. On the other hand, the manufacture of gas cost £114,272; distribution, £36,959; and management, £6652—the total expenditure being £173,378, against £158,457. The balance carried to the profit and loss account is £45,201, compared with £43,194 this time last year. The working statements show that 83,625 tons of Newcastle coal and 1,413,154 gallons of oil were used in the production of 1,316,624,000 cubic feet of gas, of which 1,208,816,000 cubic feet were sold and 1,223,816,000 cubic feet accounted for. The estimated production of residuals was: Coke, 52,286 tons; breeze, 6523 tons; tar, 977,542 gallons; ammoniacal liquor, 22,763 butts.

CELEBRATING THE GAS COMPANY'S VICTORY AT HULL.

Presentations by Workmen to the Manager and Secretary.

In view of the feeling entertained by the present Government and their followers towards the House of Lords, it will be of interest to notice the proceedings at a gathering of the employees of the East Hull Gas Company which took place at the offices last Friday afternoon, as it amounted to a very hearty approval of the course adopted by the Upper House in rejecting the gas-works purchase clause in the Bill promoted by the Corporation. On hearing of the decision, one of the workmen suggested that presentations should be made to the Manager (Mr. John Holliday) and the Secretary of the Company (Mr. David Wood), as a recognition of the esteem in which they are held. This was taken up with enthusiasm, and the result was that on the above-named day each of these gentlemen was presented with a handsome case containing a beautifully engraved silver sovereign case, match-box, and card-case, together with a gold-mounted walking-stick. There was an enthusiastic gathering of the employees, everyone of whom had subscribed to the gifts. Mr. John Pipes (the Superintendent of the Outdoor Department) returned specially from his holidays to preside at the gathering.

Mr. Benson, an elderly employee, in making the presentation, spoke of the kindly feeling which existed between the heads of the Company and the workmen. He complimented the Manager and the Secretary on the matter they had prepared, which had resulted in so brilliant a success being achieved for the Company. Mr. Benson was followed by Mr. Wood, who next Tuesday will have completed thirty years' service with the Company. He referred at length to the parliamentary struggle with the Corporation, and said that, now that the Company had a new lease of life, they only required the united efforts of everyone to gather an increase of business as the years rolled on.

Mr. Holliday, in the course of his remarks, in acknowledging the gift to him, said they, as a body of men working together, received the possibility of changes with what he was sure was a natural unrest; but they were reaping the harvest of their work. Mr. Wood and he, however, could have done little—and he wished to make this perfectly clear—without the united support and assistance of every department connected with the undertaking. Having referred to the parliamentary fight, he said the municipal authorities and the Company were going to work together as amicably in the future as they had done in the past, as was generously admitted by Alderman Larard in his evidence. Before sitting down, Mr. Holliday mentioned as a fact of interest that the working result of the past six months showed unexampled prosperity on the part of the Company; and he said he felt certain they would have no difficulty maintaining this in the future.

Mr. George Taylor (the retort-house foreman) having added a few remarks,

Mr. J. J. Runton (the Chairman of the Company) referred in complimentary terms to the Manager and the Secretary; remarking that there was not the slightest doubt that if they had gone to the Committee with a weak case they would not have succeeded so well as they had done.

The proceedings closed with votes of thanks.

The Award in the Poulton-le-Fylde Arbitration.—We understand that Mr. Graham Harris, M.Inst.C.E., the sole Umpire in this arbitration (see *ante*, p. 114), has made his award, the amount of which is £5681.

Melbourne Metropolitan Gas Company.—The profits of this Company for the six months ending the 30th of June were £60,000. A dividend of 5s. per share has been declared for the half year, a sum of £17,500 placed to the reserve fund, and a balance of £2750 carried forward.

Samlesbury Water Scheme.—A much-needed benefit was conferred on the township of Samlesbury last Wednesday, by the completion of a scheme by which water is drawn from the Thirlmere aqueduct of the Manchester Corporation. The scheme comprises 13 miles of mains, 11½ miles of which were laid by the Preston Rural District Council, while the remainder were taken over from the Blackburn Corporation, who, on establishing their sewerage works in the district, laid a main and built a meter-house. The work has cost something over £4000. The opening ceremony was performed by Mr. W. Pye, the Chairman of the Council, who turned on the water with a key presented to him by Mr. H. Heaton, on behalf of the Engineers (Messrs. Myres, Veevers, and Myres).

NEYLAND GAS ARBITRATION.

An inquiry has lately been held at Neyland, by Mr. W. A. M'Intosh Valon, as Umpire, in the matter of the purchase by the Neyland Urban District Council of the works, mains, and plant of the Pembroke Docks and Town Gas Company, situate within the urban district. The Arbitrators were Mr. Norton H. Humphrys, Assoc.M.Inst.C.E., for the Gas Company, and Mr. Charles E. Baker for the District Council; but, having disagreed, they did not take part in the proceedings. The Company's original claim amounted to £2876 5s. 5d.; but evidence was given on an amended claim of £3003 18s. 3d.—the difference being made up of new services laid and new meters and stoves fixed since the notice to treat was given. The valuation put forward by the Council as the amount expended by the Company on works, mains, and plant within the Neyland district was £1128 1s. 11d. They contended that they were not liable for the additional claim of £127 12s. 11d.; but should the Umpire be against them on this point, they claimed that the amount should be £107 5s. 5d. The Counsel engaged were Mr. Sankey for the Company and Mr. Rhys Williams for the District Council; and the witnesses called on behalf of the respective parties were the Managing-Director, the Manager, the Solicitor, and Mr. C. Stafford Ellery (the Engineer of the Bath Gas Company) for the Company, and Mr. F. J. Warren (Accountant) for the District Council.

WOLSTANTON AND BURSLEM GAS ARBITRATION.

The Value of Part of an Undertaking.

At the Surveyors' Institution, Westminster, on Monday last week, arbitration proceedings were opened between the Wolstanton United Urban District Council and the Corporation of Burslem, to determine the amount of compensation to be paid to the Corporation in respect of the mains, pipes, and fittings within the district of the Council, who are taking over the supply of gas in their own area under their Act of last year. The claim was for upwards of £32,000.

Mr. W. A. M'Intosh Valon was Arbitrator for the Corporation; Mr. Corbet Woodall acted in a like capacity for the Council; and the Umpire was Mr. A. J. Ram, K.C.

Mr. J. D. Fitzgerald, K.C., and Mr. R. S. Clease (instructed by Messrs. Sharpe, Parker, and Co., of Westminster, and Mr. A. Ellis, Town Clerk of Burslem), appeared for the Corporation; and Mr. E. Honoratus Lloyd, K.C., and Mr. C. C. Hutchinson (instructed by Messrs. Batten, Proffitt, and Scott, of Westminster, and Mr. E. Hollinshead, the Clerk) represented the Wolstanton Council.

Mr. Fitzgerald, in briefly opening the case, said there were several heads of claim, the first being for the value of the mains, pipes, and other works; and on this they would hear, from the evidence of the Engineers, that they were in most excellent condition. Another head of claim was for damage for severance (under section 63 of the Lands Clauses Act), loss of interest, establishment and management charges, &c. A third head raised a point of law as to the loss of the supply in the district, and the consequent loss of revenue. This was the largest head of the claim.

Mr. *Charles Hunt*, examined by Mr. Clease, submitted figures to show that the average rate of increase in the consumption of gas in Burslem for the past five years was 1·59 per cent. per annum. Taking this figure, he estimated that the consumption of 26,114 000 cubic feet of gas would not be overtaken by the increase in Burslem in less than 8½ years, during which time there would be the loss of interest, diminishing, of course, yearly. Calculated at the rate of 4 per cent. per annum, the loss of interest totalled up to £1107. As to the management and establishment charges, those which might be regarded as of a permanent nature came to rather more than 1d. per 1000 cubic feet of gas sold, or (say) £110 per annum on the standing consumption. This again would be a diminishing figure, and he put it at £484. The 10-inch main from the works to the boundary of the district was used to supply Wolstanton as well as a small portion of Burslem *en route;* and this, to a very great extent, would be rendered unproductive. He estimated the value of the loss there at the difference in cost between a 10-inch and a 4-inch main. This was about 7s. 2d. per yard; and 450 yards worked out at £161 5s. These three sums made together £1752 5s. With regard to the loss of revenue, he took the published accounts of the Corporation, and they showed that the balance carried to profit and loss account for the year 1907 was £11,832. This was after deducting expenditure upon maintenance of works, plant, mains, meters, services, and stoves at the rate of 6·38d. per 1000 cubic feet of gas sold, and also £992, the cost of the opposition in the Wolstanton case. The proportion of the £11,833 which he attributed to Wolstanton was £1508. He based this figure on the consumption. Capitalized at 4 per cent., it represented a capital value of £37,700. From this sum he deducted the value of the mains, pipes, and other works to be taken over by the District Council—£11,388—also the £1752 and the value of the works at present in use for the supply of Wolstanton, estimated at £5876. Deducting these three sums, which he made £19,016, he got a total of £18,681. The heads of his valuation were: Value of mains, pipes, and other things, less depreciation on meters and stoves, £11,388; he added 10 per cent. for compulsory sale, £1139, making £12,527; and then he added for damage resulting from temporary reduction of consumption and mains thrown out of use £1752, and for reduced profit £18,684—making a total of £32,963.

In cross-examination by Mr. Honoratus Lloyd, witness said the claim was intended to be for £32,000 odd. When he gave £37,700 as 25 years' purchase of the Wolstanton revenue, he deducted the amount of the other claims. If in law they were entitled to mains, pipes, and fittings, he claimed first of all the item of £11,388, *plus* £1752 for severance damage. On the other basis in law, he claimed £18,684. Asked on what basis he claimed the two, witness said if the Corporation asked for profits alone, the claim would be £37,700, less the value of the works left on their hands, which he put at £5876. His claim on that basis would be roughly £32,000. This was on the basis of his claiming goodwill; and it was practically a claim for goodwill. He had not allowed anything for depreciation of mains or service-pipes, because they were in excellent condition.

Mr. Honoratus Lloyd: With regard to other items, for "Enforced idleness of works," you have given us £225 per million cubic feet output—£5876 on the 26 millions in Wolstanton. I observe by the figures you have put in that the Burslem increase has varied; for instance, between 1903 and 1904 nearly 10 millions. Do you know to what that was due?

Witness: I do not know; fluctuations naturally occur.

In further cross-examination, witness said he had taken the rate of increase at 1·59 per cent. per annum over five years from 1902 to 1907. He had not calculated what it was between 1903 and 1904. It would be considerable if in that year they went up nearly 7 millions. If this occurred again, he admitted that their idle works would be pretty well employed; but they had to reckon on an average of years. As to loss of revenue, the accounts were made up to the 31st of March this year; and they showed an expenditure of more than 6d. per 1000 cubic feet for repairs and maintenance, and also the expenses of opposing the Wolstanton Gas Bill, £929. After these deductions, there remained £11,832. The item of £1508 was the percentage of consumption in Wolstanton applied to the total; and he had taken 25 years' purchase on this. He had based it upon the percentage at which they had lately been able to raise their loans—the last loan being at 3⅞ per cent. The Corporation raised their loans on the total rates.

Mr. Honoratus Lloyd: So you take the income of the gas-works as well secured because the Corporation can levy money on the security of the whole rates at a certain percentage. Is that what you mean?

Witness: I say that is the amount which they have to pay for their loan. Therefore it seemed to be a fair amount at which to capitalize these profits.

What we are doing for this purpose is to ascertain the capital value of their gas profits. What has that to do with the price they pay for their loans?—It is always more or less based upon the value of money at the time, and that is the value of money to them.

But first of all we have to deal with the security of their gas income. The price at which they raise their loans on all the rates is very little affected by the security of the gas undertaking?—That is rather favourable than otherwise. I might have asked a greater number of years' purchase.

What I want to get at is this: How does the price at which they can borrow money, except as being some evidence of the state of the Money Market, affect the security of their gas undertaking?—I do not think the price at which they can borrow money does affect it, but it does affect the value of an undertaking—the value which they would pay for it.

But just suppose for a moment that they made no profit on the gas-works, do you think they would not raise the money at the same rate?—I doubt if they would.

To what extent do you think it would affect it?—They would have to pay a higher rate, I suppose. I can imagine, if they had no revenue out of which to pay their interest, their borrowing powers would be limited.

That is not the point. They have the whole revenue of the rates upon which they could borrow. Whether the gas undertaking is a success or whether it is a failure, they have the security of the rates just the same. And it is upon these rates that they borrow. Can you give me any reason beyond that why you are taking 25 years' purchase?—No; I based it upon the value of money.

In further cross-examination, witness said that Chard was one of the gas undertakings in which he valued on the revenue. He put it at 19 years' purchase; but that was a non-statutory concern. In the case of Nantwich, which was also a non-statutory undertaking, he gave 19½ years' purchase. He could not say what difference he would make between statutory and non-statutory concerns—he could not give the number of years; but he should think it would be about five. This was what he generally did. The rest of his valuation was merely a deduction from the £37,700; 26 years' purchase and the two former figures he had given. He arrived at the £5876 by an estimate. It worked out at £225 per million cubic feet of gas; and this was a fair figure for works of the size of those in question. Within limits, the larger the works, the cheaper they were. The 10 per cent. on mains, pipes, and fittings was intended to represent compensation for compulsory purchase, which he understood to be the case here.

Mr. *Arthur Valon*, examined by Mr. Fitzgerald, said he had made a valuation of the works concerned, and arrived at a total of £34,266. As to the item "Works thrown out of use," he had taken the quantity of gas sold in Wolstanton in the last years—26,114,000 cubic feet—and multiplied this figure by £250 per million as the structural value of the works and plant of the Burslem Corporation thrown out of use by the sale. Then he calculated that it would take 8½ years to make up the above-named consumption. He had discounted each year the value for the length of time which they they would have to wait until the increase in Burslem itself made up the gas lost. Having gone through other details, witness said he had dealt with the diminished profit in exactly the same way as Mr. Hunt had done; and he agreed with him that the mains were as good as new.

In cross-examination by Mr. Honoratus Lloyd, witness said his figures were substantially the same as those of Mr. Hunt. He had not allowed depreciation anywhere, because taking the whole of the claim together, the depreciation was charged against the revenue before arriving at a profit. If he allowed depreciation on the first item, the amount claimed under the head of "Payments" would be larger; so that it made no difference.

Mr. Honoratus Lloyd: What I am going to put, as a matter of law, is that we have nothing to do with profits. All we have to do is to buy the depreciated mains and fittings.

Witness: If you want depreciation, I think 10 per cent. on meters and stoves is sufficient to cover it.

Mr. Hunt gave us 20 per cent. on one and 25 per cent. on the other. You have, in fact, taken off a larger sum for the profit?—It makes no difference. If I take 20 per cent. off for meters and stoves, it would simply be taking it off that item and putting it under the same thing as profits.

Mr. WOODALL: Have you increased the amount for renewals?

Witness: The amount allowed under the head of "Repairs and maintenance and renewals" is sufficient to repair and renew the whole of these works. If I allow a certain deduction from the structural value, I must deduct a corresponding amount from the maintenance in the account before arriving at the profit made.

Mr. VALON: Then you have not made any addition to the amount actually spent by the Corporation in their renewals?

Witness: No; because there is already sufficient in the account to cover repairs and renewals.

Mr. HONORATUS LLOYD: Wby do you put 10 per cent. for compulsory purchase?

Witness: Because we are going to add 10 per cent. for compulsory purchase under the Lands Clauses Act, on the structural value of the works.

It seems to me you must be wrong one way or the other. Your claim is upon the goodwill basis; but you have put down diminished profit. If you claim 10 per cent., you are claiming it upon that.

Mr. FITZGERALD: He is not claiming 10 per cent. upon the diminished profit.

Mr. HONORATUS LLOYD: I want to see on wbat principle he bas acted. [To witness:] Though it is a goodwill basis, you have not asked for any percentage upon the goodwill, but you bave asked for 10 per cent. upon the structural value?

Witness: It comes to the same thing.

Mr. HONORATUS LLOYD: Therefore it is goodwill pure and simple; and in arriving at the goodwill, you have taken the structural value, and then you have taken 10 per cent. upon that.

Mr. FITZGERALD: If it will oblige you, we will put it on to the other. I think the case is very simple that is before you now.

Mr. HONORATUS LLOYD said he would address the tribunal very briefly, call his evidence, and complete his case. The main point was the point of law; and upon this his learned friend desired tbat the Umpire should state his award in the form of a special case. Therefore, if he proposed to do this, he need not argue the matter.

The UMPIRE said that be should like to have the assistance of both learned Counsel. They were aware that the value bad to be ascertained by a certain day. He took it, if he stated bis award in the form of a special case, by so doing he would comply with the terms of the statute that the amount must be ascertained on a certain day, even though he did it in the alternative. He asked whether this was the opinion of Counsel.

Mr. FITZGERALD said the words were "shall be determined by arbitration within twelve months from the passing of this Act."

The UMPIRE: Is it sufficient determination if I state an award in the alternative, subject to the ruling of the Court upon the alternatives tbat I submit to them?

Counsel on both sides agreed to let the point go on tbe lines that were suggested.

Mr. HONORATUS LLOYD said he need not trouble the tribunal on the question of law, because he would have to address the Court bereafter if the Umpire put the award in the form of an alternative.

The UMPIRE asked Counsel to state the precise form in wbich he desired him to raise the point.

Mr. HONORATUS LLOYD said that he would raise it in this way: His learned friend had put in a claim which, in form, he was bound to say be did not understand. It was not an alternative claim to start with; and that was wby he ventured to suggest it was not clear. He thougbt his learned friend, if be wanted to raise the point, would have said: "I am going to claim upon a goodwill basis," and then leave him (Mr. Lloyd) to raise the point as to mains, pipes, and fittings; or he would have said: "I am going to claim in the alternative one way or the other." But the claim was neither, and seemed to be a mixture. What he was going to put was this—that, upon the construction of the two Acts, what he had to buy and pay for was the mains, pipes, and fittings. Then it seemed to him, by the way in which his friend had framed his case, that there might be possibly three alternatives. He might say: First alternative, mains, pipes, and fittings pure and simple; second, mains, pipes, and fittings, *plus* compensation for severance (physical severance—the items given as to the 10-inch mains, and so on); and, third, the goodwill basis. His (Counsel's) contention was, first, mains, pipes, and fittings purchased only; secondly, it could only, at the worst, from his point of view, be mains, pipes, and fittings, *plus* physical severance, and under no circumstances could goodwill or allowance for loss of profits be made. This being so, the way be supposed it would have to be raised was to have the award in the form of the alternatives. So far as his first point went—mains, pipes, and fittings value—he was not going to trouble the tribunal with more than a few words; because it was idle to discuss the question of 2d. and 3d. per yard for laying pipes. The real question between them was whether or not depreciation should be allowed when they were purchasing pipes whicb varied from one up to forty years of age. He was bound to say he thought, after Mr. Valon's evidence, it was admitted that depreciation must be allowed, if an admission was required. With reference to tbe depreciation on meters and stoves, the percentage was common to them both. The other side said 25 per cent., and so did he; and the result was that, while their figure for structural value of mains, pipes, and fittings came out, according to Mr. Valon, at £12,500 odd, and according to Mr. Hunt at £11,300 odd, his (Mr. Lloyd's) figure was about £8000 odd. He submitted that, at the utmost, the other side could not be entitled to more tban any loss tbey might suffer by physical severance; and that they were entitled only to the actual price of the mains, pipes, and fittings as awarded in the Kirkleatham and Wakefield cases. Counsel proceeded to deal with the claim in respect of the loss of interest diminishing year by year, but extending over 8½ years for the capital expended in such part of the works as was necessary to give the supply, and also with the management and establishment charges. He next examined the main claim—the loss of revenue—to wbich he said he objected altogether in law. If tbere was a claim for goodwill, as this was, pure and simple, then if they wanted a percentage they should bave had the courage to say they required 10 per cent., 5 per cent., 2½ per cent., or any other percentage. Why sbould they ask for 10 per cent. on the structural value? It was inconsistent with either of their cases; and he did not dilate upon this because bis case was that they were not entitled to 10 per cent. upon anything. If they obtained his figure of £8000 odd, or their figure of £12,000 odd, for the works, or something between these figures, they would certainly obtain all they were intended to have when they took over the works under the terms of the Act.

The following evidence was then given for the District Council.

Mr. *Henry Woodall*, examined by Mr. HUTCHINSON, said bis firm (Messrs. Corbet Woodall and Son) supported the Bill of the Wolstanton District Council in Parliament, and he had an intimate knowledge of the undertaking. He had recently been laying mains in Wolstanton, and had prepared a valuation in which he based his figures upon the actual prices they had paid at the present time. He had taken 20 per cent. depreciation on mains, and this was based on experience he had had of the mains in tbe Chesterton district, which was part of the Wolstanton area. It was a reasonable figure. He had taken 33⅓ per cent. as regarded service-pipes. As to stoves, 25 per cent. had been agreed upon; and on meters he bad taken 20 per cent. His total valuation amounted to £8041.

In cross-examination by Mr. FITZGERALD, witness said, with regard to the mains, he did not base his depreciation altogether upon his Chesterton experience, which would have led him to take a larger amount. He had not seen the Wolstanton service-pipes, nor the mains in the town; but he bad had the latter examined in a large number of places. He was not prepared to say that they were not in good condition; but he differed entirely from Mr. Hunt wben he said that they were as good as new.

Mr. *E. H. Stevenson* said he bad made a valuation of the mains, pipes, and fittings, and his summary showed a total of £8025. He had added 5 per cent. for special pipes, against 10 per cent. taken by the other side. He took the depreciation on mains as 20 per cent., which was in accordance with his experience. The number, size, and make of stoves were all obtained from the other side, with the curious result tbat they (the Council's witnesses) had really allowed more for depreciation. He divided the meters into the ordinary wet, dry, and slot; and be then deducted tbe 20 per cent. He had taken the average cost of service-pipes at 10s., which was ample. He took the depreciation at 33⅓ per cent., which was in accordance with his practice. The total amount of bis valuation came to £8335.

Mr. *Bennett Parkinson* gave evidence as to the opening of trial holes in Wolstanton with the object of inspecting the mains and services. He saw the older mains were rusty; but the new ones looked smootb. He could not say he noticed that any were corroded. The general impression was that their condition was fair; but they certainly looked their age. The services were supposed to be enclosed in troughs; but for the most part they had never been in tbem.

Mr. HONORATUS LLOYD baving stated that he did not desire to further address the tribunal,

Mr. FITZGERALD contended that the Corporation of Burslem bad submitted their case in such a way that separate judgments could, if necessary, be given on each of the three heads of claim; and he tbougbt his friend ought to have been grateful to them for so doing. Counsel proceeded to argue upon the separate heads of the claim. He said the only question before the Umpire was the number of years' purchase; and on this tbere was no conflict of evidence. He therefore asked that 25 years' purchase should be declared a reasonable amount.

The UMPIRE inquired under wbat head Counsel asked for any amount in respect of what had been described by Mr. Fitzgerald as "loss of revenue," and by Mr. Lloyd as "goodwill."

Mr. FITZGERALD replied that be should say "in respect to the loss of revenue from the township of Wolstanton," the right of supply of whicb was, by the terms of the Act, taken away from the Corporation of Burslem and transferred to the Wolstanton Council.

The UMPIRE remarked that the three points raised by Mr. Lloyd had been dealt with by Mr. Fitzgerald. As to one, there was no dispute; but with regard to the others, there was.

The proceedings then terminated; and the amount of the award will be announced in due course.

SEAFORD GAS PURCHASE QUESTION.

Ratepayers Decide against the Proposal.

Last week, a public meeting of ratepayers was held at Seaford, to consider the advisability of the Urban District Council promoting a Bill in the next session of Parliament to acquire the undertaking of the Seaford Gas Company.

The gathering was presided over by Mr. W. P. Morgan, the Chairman of the Council, who explained that the gas undertaking was a private concern, without statutory powers, and so laboured under certain disadvantages. So as to improve their position, some montbs ago the Company decided to apply for a Provisional Order, which, if granted, would give them certain statutory powers, and materially strengthen their position. Among other things, of course, it would give them a monopoly of the supply of gas in Seaford and district. The Company accordingly drew up a draft Provisional Order, wbich they submitted to the Council for approval. To several of the clauses the Council strongly objected—more particularly to those in whicb the capitalization of the Company was placed at a figure which in the Council's opinion was much too high, and in which the maximum charge was placed at 5s. per 1000 cubic feet. These and other clauses the Council considered would be detrimental to the best interests of the ratepayers; and they opposed the Order. In consequence of this opposition, the Company dropped their application for an Order; and the Council then considered the advisability of promoting a Bill in the next session for the purpose of buying the undertaking. In doing this, they were merely acting upon powers which were granted to urban district councils of buying up, or promoting Bills for the purpose of buying up, any gas or water company; and, of course, the Company must have known perfectly well that they were liable at some time to be bought up by the Council. The Council were also acting upon a clause in the draft Provisional Order, in which the Company said that if within the next five years the Council, *bonâ fide*, promoted a Bill in Parliament for

the purpose of buying up the undertaking, the Company would not oppose, but would sell at a price to be fixed by arbitration if the parties could not agree as to terms. The General Purposes Committee of the Council, after carefully considering the question, recommended the Council to promote a Bill, because they believed that the undertaking could be worked at a profit, and the profits would go to the relief of the ratepayers in some form or another. The Council adopted the report of their Committee, and decided to promote a Bill, provided the ratepayers gave a favourable opinion on the proposal; and the present meeting was called to test this feeling. The Council were actuated by no feeling of hostility to the Gas Company; but being, as it were, trustees for the ratepayers, they considered they would not be doing their duty if they did not draw attention to the opportunity that now offered itself to acquire the undertaking at a reasonable price—certainly at a more reasonable price than it would ever be possible to acquire it in the future. He concluded by moving a resolution in favour of the promotion of the Bill.

This was seconded by Mr. Plaister and supported by Mr. Fuller; and then the opposition took the field. Mr. Barraclough (the Chairman of the Company) said the Company would not be willing sellers; and the purchase clause was only inserted in the draft Provisional Order because the Chairman stated that the Council would not assent to the Order without it. Therefore the buyers would be liable to pay 10 per cent. for compulsory purchase. In Sussex, Surrey, Hampshire, and Kent there were about 93 gas undertakings, and 88 of those were run as private concerns, while five were run by the local authorities. The average price of gas of the 88 companies was 3s. 6d. per 1000 cubic feet; but the average price charged by the five local authorities was 3s. 8½d. That was municipal trading. In his opinion, the Council would have shown their wisdom if they had lain low until the Company had got the price down to 4s., and then have bought them out. That was what they ought to have done. A Ratepayer: We should all have been dead before that happened. Mr. Barraclough retorted that a resolution was passed by the Directors three months ago to reduce the price of gas in Seaford; but it could not be put into effect owing to the abnormal increase in the price of coal. The Council, he added, had for the moment plenty to do to get the town into a proper health resort. They had had the water question, and had a "little bit of a rap" over that. They did not want another. It was by no means certain that if they applied for their Act they would get it. A case was settled a fortnight ago in which the Hull Corporation went to Parliament with a Bill to purchase the East Hull gas undertaking. It passed the House of Commons; but the House of Lords threw it out. The consequence was that whatever this had cost the ratepayers would have to pay out of the rates.

The next speaker, Mr. Hadlow, said the gas was bad; and at his hotel the guests carried their candles down to table d'hôte. One lady, referring to the gas, said: "What a lot of Roman candles you have in the house." The gas gave three military salutes, and out it went. It was most polite gas. Mr. Hooper remarked that he did not agree with his colleagues on the Council in regard to this question. In the Act of 1870, there was a clause which said that in the event of putting up new holders or new works other than the present ones, they would require the consent of the tenants and owners of houses and land within 300 yards' radius. If they bought the undertaking, did they think the Trustees of the Crook Estate, which nearly bounded the works, were going to be friendly and say "Yes"? This was the weakest point of the Company's Order, because it was difficult to get their own tenants to consent to an extension of the works. The Seaford West Company were, he believed, favourably disposed towards the purchase; but would they give the Council *carte blanche* to extend the works? Did those present think it was likely? The consequence would be that, if they bought the undertaking, they would not be able to extend the works, and they would have to be shifted. This would be a grave difficulty for the Company; but if the town purchased the undertaking, it would be a grave difficulty for the ratepayers. He was followed by Mr. Hutchings, who remarked that an important question to be considered before deciding to purchase was the state of the works and of the mains, some of which were laid 20, 30, or 35 years ago. They might take it from him that they would not get an arbitrator to go into the details of the mains. He would take a general view of the affair, and base his result on the profit of the Company, which would mean a large outlay for the ratepayers. Mr. Jack, who supported the resolution, mentioned that the Company refused to allow the Council's Engineer to inspect the works; but this Mr. Barraclough denied. He added that, in the event of the Council allowing the matter to drop, he would propose a resolution at the meeting of Directors that a reduction should be made in the price of gas from September next.

Several other speakers joined in the discussion; and then the resolution was put to the meeting. Only a few, however, voted for it; and the Chairman declared it not carried.

Increased Cost of Coal at Birmingham.—Dealing with the subject of the rise in the price of coal, Mr. G. Hampton Barber, the Secretary of the Birmingham Corporation Gas Department, has informed a representative of the "Daily Post" that the additional cost will, on the average, be a little over 2s. a ton; and this, on the amount of coal carbonized, represents an increased charge of over £50,000. An additional income, however, will be derived from coke and other residual products. It is also expected that a larger amount of gas will be sold; while some economies are to be effected. These considerations afford the Committee hope that, without advancing the price of gas, the contribution of the department of £50,000 in aid of the rates will be maintained. This, our contemporary adds, will be very gratifying to the ratepayers, especially when it is remembered that during the past year the average price charged by the Corporation for gas was the lowest in the history of the undertaking. It is explained that the coal contract year does not run concurrently with the financial year—the latter ending on March 31, the former on June 30. For three months of the present financial year, therefore, coal was secured at the lower rates under the contracts entered into by the Gas Committee in 1906.

GAS WORKERS' STRIKE AT LIMERICK.

Limerick has been the scene of a strike of gas workers which has caused a considerable amount of inconvenience, without apparently any compensating advantages to anybody. The trouble began, it is stated, last Thursday week, when the Manager (Mr. Henry Hawkins) told a carpenter to shift a ladder which was leaning against a new purifier-house. The carpenter took no notice; and the Manager repeated the request to the man's brother, who followed, and who called out: "Tell him to get a labourer to do it. It is not joiners' work to be shifting ladders." The Manager asked why such a remark was made, and said he would remember it. As a result of the dispute which followed (in the course of which the Manager said the man first in fault had told "a lie"), the original offender was suspended. But next day he called at the works and persuaded a deputation to go with him to see the Mayor, who told them they had no case. Then followed the strike; the men declaring that they would all act together till the whole thing had been thrashed out by the Gas Committee and themselves. Among the conditions set out by the men on which they would return to work was the "discharge of the Saxon;" but this was soon dropped, and ultimately the men expressed their willingness to let bygones be bygones if they were paid for the time lost.

So things went on until last Tuesday, when the Gas Committee unanimously decided to give notice to the workers that unless they resumed their occupation at once, or first thing the following morning, the Committee would, in the interest of other industries in the city thrown, or about to be thrown, idle, be reluctantly compelled to employ other people to carry on the work. They expressed the hope that the men would realize at once the misery and want that would fall on the poor of the city if their bread-winners were deprived of employment. Then followed a long list of firms who had intimated that unless their usual supply of gas was immediately restored they would be obliged to close down their works and disband the hands. The Committee also drew attention to the difficulty of caring for the insane at the asylum. The men thereupon returned to work; and the supply of gas was partially resumed at noon on Thursday. Since the previous Friday, nearly all the streets had been in darkness (the exceptions being those electrically lighted); and the loss from a trading point of view must be very heavy. One outcome of the strike was the fitting of an electric motor for the printing of the "Limerick Chronicle," in place of the gas-engine previously employed for the purpose.

GAS AND WATER ADMINISTRATION AT BARRY.

The decision of the Barry Gas and Water Committee (recorded in last week's "JOURNAL," p. 266) to recommend the Council to place the two undertakings under one Manager, and to determine the engagements of the Gas Manager (Mr. F. M. Harris) and the Water Manager (Mr. E. W. Waite) caused quite a sensation in the town; and on Monday evening of last week a largely attended public meeting of ratepayers was held to consider the matter. After several suggestions had been dealt with, a resolution was carried without a dissentient, to the effect that the meeting observed with concern the proposals of the Gas and Water Committee to discharge Messrs. Harris and Waite, and to appoint one Engineer in their place; and believing that this was contrary to the best interests of the town, and to the report of the expert Engineer called in by the Committee, the meeting felt grave urgency should be shown before the recommendation of the Committee was adopted. Mr. Davies urged that Mr. Porter, the expert engaged, made no reflection whatever in his report on either of the officials concerned. On the contrary, he described the distributing plant as being in an efficient state, but said that the establishment was undermanned. Several of those present paid a tribute to the faithful and efficient services to the town which had been rendered by both Mr. Harris and Mr. Waite for a great number of years; while, on the other side, it was pointed out that the Committee had had the question under consideration for the past three or four years, and that some respect should therefore be had for their opinion and judgment.

The following day, a special meeting of the Urban District Council was held, when the Committee's recommendations regarding the placing of the two departments under one Manager, and the terminating of the engagements of Messrs. Harris and Waite, were agreed to. The recommendation that a Manager for the joint departments should be appointed at a salary of £400 a year was, however, referred back.

Speaking on the proposal to dispense with the services of the present Gas and Water Engineers, Mr. Hogg said he had studied carefully and seriously the report of Mr. Porter, and found that, while it criticized the Committee, it did not contain a word of criticism or condemnation of either of the Engineers. Both these gentlemen had been Engineers of the concerns ever since Barry was Barry; and there had never been any suggestion that they had ever done anything underhanded—nothing of a shameful nature—no suggestion that they had received commissions, or rebates, or anything of that sort. He was pleased to say this to the credit of every member of the official staff of the Council. What were the charges against the Engineers? One of the charges against the Gas Engineer was that he had used a high-priced coal when a low-priced coal would have done; and that the high-priced coal had not produced more gas than the inferior article would have done. Mr. Harris surely could not be blamed for the coal which had been bought; for he was acting under the direction of the Committee, whose business it was to determine the matter. It was true they had not had the tests which they had asked the Gas Engineer to carry out; but it should be borne in mind that the Engineer's first and foremost business was to make gas. As a matter of fact, Mr. Harris had made several tests; but the coal used had not proved a success, and he had had no time, owing to the great demand there was for gas to supply the town, to complete further tests which he had been asked to make. He hoped it was not necessary for him to prove that the Engineers had not done anything wrong. There was no charge of misconduct in any way brought against them. Their

work had been a success; and they had carried out their duties with honour and probity.

At the conclusion of the meeting, Mr. Hogg gave notice to move the recision of the Council's resolution approving of the recommendations of the Gas and Water Committee.

FATAL ACCIDENT AT MANCHESTER.

The Bradford Road works of the Manchester Corporation Gas Department were last Tuesday the scene of an accident by which one workman was killed, and the lives of two others were placed in jeopardy.

It is stated that at eleven o'clock in the morning, two men named Prior and Bell started off to test one of the syphons—a job which the regulations stipulate shall always be undertaken by two men together—and the former went to the pit, some 3 or 4 feet deep, and took out the plug for the purpose of dealing with any obstruction. He did not, however, immediately replace the plug, and the escaping fumes rapidly overcame him, and he fell with his head in a pool of water. Bell, who was close to the pit, at once went to the rescue; but he, too, was overcome, and collapsed at the side of his mate. An alarm was at once raised, and in a few moments the foreman, William Surrey, arrived. He tried to reach the two men; but by this time the fumes were very powerful, and he, too, fell down insensible. A large number of workmen gathered round the place; and at last the three men were drawn out. The men finally stopped the rush of gas by putting waste into the hole from which the plug had been taken. A doctor was quickly on the spot; but Prior was beyond human aid. The other two men were removed to the hospital; and although for some hours they were in a critical condition, they were by night reported to be out of danger. This is the first serious accident of the kind that has taken place at the Bradford Road works. All three were skilled workmen and knew exactly what to do. The great bravery shown by Bell and Surrey in their attempted rescues is the one bright feature of a sad occurrence. They exhibited that spirit of heroism which is so very frequently witnessed in connection with industrial accidents, and which leads men, without a moment's hesitation, to rise to the noble height of placing their comrades' lives before their own.

The inquest was held on Friday, when a verdict of "Accidental death" was returned; a few suggestions being made by the Jury for the better safeguard of the workmen. Mr. J. G. Newbigging, the Chief Engineer, said that deceased was used to this work. The plug had to be unscrewed until there was an issue of gas, which denoted that the pipe coming from the main was clear of obstruction. If the pipe was found to be clear, the plug had to be screwed tight again. This was done twice a day for testing purposes. If the pipe was not clear, it was the men's duty to report it to the foreman. There were always two men together when the testing took place. If the pipe was clear, there was no necessity for the entire removal of the plug. It was against the men's instructions to remove it. It was the foreman's duty to clear any obstruction. There was no risk whatever when ordinary precautions were taken. There had been no accident of the kind at the works before; nor had he heard of any such accident elsewhere. In the face of this occurrence, however, they would certainly do something to make it even safer for the men. The foreman, Surrey, said deceased had been entrusted with the duty of testing the syphons for about eighteen months. Two men were always together when it was done. They reported to him when they found an obstruction; but they had authority to clear it—he had allowed them at times to do so. If the plug was taken out, a piece of cotton waste would stop the gas from escaping while the work of clearing the pipe was on. The men had appliances for use in case of emergency. If the waste had been used on this occasion when the plug was out, there would have been no danger whatever. The Coroner remarked that the most cheering feature of this unfortunate accident was the brave attempts made at rescue by so many workmen; and he congratulated them on their plucky conduct. If blame was attachable to anyone at all in connection with the accident, it was to Prior himself; for he had neglected the very necessary and obvious precaution of packing with waste the hole where the plug had come from, so as to prevent an escape of gas.

Projected Electric Lighting Demonstration in the City.

At the meeting of the Court of Common Council last Thursday, it was unanimously resolved, on the recommendation of the Streets Committee, that certain proposals for demonstrating improved electric lighting in several of the main streets of the City should be accepted. They were as follows: By the City of London Electric Lighting Company, on the Holborn Viaduct, by means of flame arcs on standards; in Farringdon Street, including part of Old Bailey and Holborn Circus, by enclosed arc lamps; and in Newgate Street, by smaller lamps. The charges for these lamps are to be at the rate of £17 10s. per annum each for the flame arcs, instead of £26 per lamp; and for the smaller lamps £12 10s. and £10 10s. each per annum respectively. By the Charing Cross and Strand Company, in Cannon Street (between St. Paul's Churchyard and Budge Row), by means of centrally hung flame arc lamps, at £17 10s. each per annum. The recommendation stated that all costs of the installations, including standards, lamps, maintenance, &c., are to be defrayed by the Companies; that the necessary works are to be proceeded with as expeditiously as possible; and that the demonstrations are to be continued until March next.

Seeking Gas Escapes.—During the past week two escapes of gas were located by means of naked lights—with somewhat serious consequences in both cases. A Harborne doctor, suspecting an escape in his sitting-room, took a light to examine the chandelier, when there was a loud report, and both he and his wife were badly burnt about the face and hands. The second instance occurred at Middlesbrough, where a woman, also suspecting an escape, entered the room, opened the window, and struck a match. Windows were broken, furniture damaged, and the woman herself had to be conveyed to the infirmary, where she was detained.

WATER SUPPLY IN SOUTH OXFORDSHIRE.

A New Reservoir at Woodcote.

Woodcote, in Oxfordshire, which is situated amid beautiful country, about 8 miles from Reading and 4½ miles from Goring-on-Thames, was last Tuesday the scene of a very enjoyable—and for the locality and the undertaking concerned a very important—function; invitations having been issued by the Chairman and Directors of the South Oxfordshire Water and Gas Company to witness the opening of a new high-service reservoir on Greenmoor Hill. A large number of ladies and gentlemen—about one hundred (many of whom were residents from all parts of the Company's district)—took advantage of the opportunity which was thus offered of combining business with pleasure; and a not inconsiderable proportion of the party travelled down with the Secretary (Mr. F. C. Robus, F.C.I.S.) to Reading, where brakes were in waiting to convey them to the site of the reservoir. This drive itself—though the day was not so clear as it might have been—was quite sufficient to repay one for the journey down from town. Most people, no doubt, place next in their feelings to pride of country, pride of their own particular county; and those who dwell in Oxfordshire are certainly not proud without a cause. Almost the whole of the way, the road led upwards; and by the end of the drive, it was apparent that a considerable height must have been reached. This was confirmed on stepping from the waggonettes; for it was seen that the Company's land was situated at the top of a commanding hill from which one looked down upon the surrounding country. For this reason, the new reservoir has been most appropriately named the "Summit." The Company was originally started in 1888 as the Goring and Streatley District Gas and Water Company, Limited, which places were first supplied in 1892 or 1893. In 1902, powers were obtained to extend the area of supply, under the title of the Thames Valley and Goring Water and Gas Company, Limited; and on June 30, 1905, the Royal Assent was given to an Act incorporating the South Oxfordshire Water and Gas Company, with power to supply a district extending from Streatley to the borders of Henley, and from Shiplake to Newington—an area of something like 150 square miles. Over 50 miles of mains have been laid, varying in size from 14 to 4 inches. Although the undertaking is a large one, the paid-up share and loan capital of the water portion is only £70,473. The plant consists of duplicated pumping machinery, which will lift upwards of 200,000 gallons of water per diem; while the storage capacity is over 3,000,000 gallons.

On arrival, the visitors were taken over the works, under the guidance of the Chairman of the Company, Mr. Henry J. Robus. It may be pointed out that there are two reservoirs, separated by the roadway. The one already in use is covered in; the new one will be similarly treated later on in the year. The Directors, however, were anxious to be quite on the safe side with regard to the summer's requirements, and so decided to bring the second reservoir into operation, and postpone just for the present the covering in. The work of construction was not accomplished without difficulty; inasmuch as after excavating the clay for some distance, a bed of sand was met with, which necessitated going down 10 or 12 feet deeper than had been anticipated, in order to secure a sound foundation. The capacity of the new reservoir is 2,650,000 gallons; and it has a partition running down the centre, so that one-half at a time can be cleaned, without emptying the water out altogether. It was constructed almost entirely by the Company's own men; and during the whole of the operations not a single workman (of whom at times over a hundred were employed) suffered any kind of accident. The Company are the freeholders of about 12 acres of land; and there is space still left for the building of two more similar reservoirs. The water is pumped from a well at Goring to Cleeve, which supplies Goring and Streatley, and is lifted from there to Woodcote, a distance of 3¼ miles; the reservoir being 620 feet above sea-level. Fortunately for the low-lying parts of the district, the pressure is so great that water can be thrown over the houses without the aid of a fire-manual. As regards the "Summit" reservoir, it may be remarked that it is a most substantial structure; and the cost has been extremely moderate—well under £15,000, including the land. The water has been shown by analysis to be of an admirable character—free from pollution by animal organic matter, and an excellent supply for drinking and domestic purposes.

When the party had assembled round the valve-house, the Rev. Mr. Nind offered a short prayer, after which Mrs. Henry J. Robus handed Sir Robert T. Hermon Hodge, Bart., a gold key, suitably engraved, with which he opened the valve-house prior to turning the water into the main. In doing so, he expressed the hope that this great undertaking would last for very many years for the benefit of the community for whom it had been built. The company then proceeded to the other end of the reservoir, on the outside wall of which, facing the public road, was an inscription stone. This was unveiled by Mrs. Robus, after which Sir Hermon Hodge presented her with a gold buckle in the shape of the reservoir. The buckle had upon it the words: "Presented to Mrs. Henry Robus, at the opening of the Summit Reservoir, Woodcote, Oxon.; 1907."

After the services of a photographer had been requisitioned, a move was made to a large tent which had been erected on the ground; and here the guests were hospitably entertained at luncheon, during which a short toast list was gone through.

Mr. H. J. Robus, after the Loyal Toast had been honoured, proposed "Health and Prosperity to Sir Robert Hermon Hodge."

Sir Robert Hermon Hodge said he could not thank Mr. Robus sufficiently for the kind way in which he had alluded to him. He did not forget that the original invitation which was given him to be there on that most important occasion was given to him at the time when he was Member of Parliament for the division; and he regretted very much that he could not appear before them that day in this capacity. He was, however, one of those who were swept away in the flood which went over the country, and which he trusted had brought with it all that those who effected it had desired. Though he was no longer a Member of Parliament, and so could not be present in an official capacity, they had extended the invitation to him as a private individual. He was only too delighted to join hands with those who had

been engaged in the great work of bringing water into this hitherto waterless region. It was a great pleasure to him while he was a Member of Parliament to do what little lay in his power to help the Bill through and secure the Act under which the Company obtained their powers. He was amazed at the opposition—at the difficulties which were thrown in the way of Mr. Robus and the Directors of the Company by colleagues of his in the House of Commons; and he was perfectly certain that their action was owing to their entire ignorance of the needs of the locality, and of the importance to the inhabitants of a good and pure supply of water. He had very often sat in the House of Commons and heard Members for the Metropolitan district talking about water famines in London—taps only running for two hours a day, and so on—and thought that if they could only come into the region he was acquainted with, where there where no taps, and people were dependent for their water supply on ponds which dried up in the summer, and where he had often seen carts go to the Thames for water for both people and cattle, they would then know better than they did what the meaning of a water famine really was. This was a locality where they were suffering from a permanent water famine; and they appreciated the fact that the Company were providing them with that necessary of life a pure supply of water. They knew perfectly well, of course, that it was not a Company of philanthropists; and he thought the people of the locality had met the Company on the whole in a friendly manner, and had shown that they were not unwilling to pay a fair price for the water which had been brought under such great difficulties to the summit of this high elevation. He believed the Company would be the means of largely increasing the value of the property in the neighbourhood, as well as of adding to the population; and certainly they would add to the comfort of all those who at present resided in the district. Further than this, he believed they would be the means of providing a great deal of work for those who needed it. After giving particulars regarding the Company, he concluded by remarking that he was sure they would one and all join with him in wishing "Good health and prosperity to those who are engaged in this undertaking, and financial success to the South Oxfordshire Water and Gas Company." With the toast he coupled the name of the Chairman, Mr. Henry J. Robus.

Mr. Robus, in responding, said he had been ill for a very long time; and he had looked forward to the opening of this reservoir in the hope that he would be fully restored to health, so that he could give them some of the little episodes that characterized a water company in its early stages, and tell them, not of the little pin-pricks they got, but of the pleasant features. He was happy to say that at the moment they were in affectionate accord with their consumers. They had not a single dispute on hand with them. They were in agreement with all the Parish Councils, Rural District Councils, and the County Council. Not one wry word was to be heard. He considered that the whole of the Councils had met the Company in an excellent spirit; they had extended that help which a young company so much desired. He might point out that he had been connected with the Company since its inception. The first year's revenue was under £5; while to-day it was well over four figures, and in ten years' time—so far as he was able to judge from the past, and looking into the future—he thought he would be able to tell them that it was not four figures, but five figures. They had got along in a first-rate manner. Their water, he might say, was of a most excellent character. Sir Robert was their largest consumer; but they had other excellent ones. He could not tell them quite how many there were; but there were large and small people, and the Company had secured nearly the whole of them. He had also wanted to tell them what happened when they promoted their Bill. He and Mr. Bodkin had interviews with the various Councils; and they found that they were composed of a practical and sensible body of men.

Mr. F. E. Bodkin, a Director of the Company, expressed the hope that Mr. Robus would soon be able to take up his duties again in the energetic style which had been of so much service to the Company. As regarded the ceremony which had been so successfully carried out that day, he thought very few people thoroughly understood the feelings of Directors of water companies. No doubt they, to the public, appeared as directing an undertaking which had an enormous district, and, of course, made enormous profits and paid enormous dividends. To the Directors of the Company, the matter appeared in a very different light. They felt now—and always had felt—the responsibility which Parliament had placed on their shoulders, and which meant that over the very large area of 140 or 150 square miles they were supposed to supply practically unlimited quantities of pure and wholesome water. They intended to live up to the high ideal to which this responsibility pointed; and consequently they had carried out, among other things, the work which had been inaugurated that day. As regarded the quality of the water, analysis had shown that, when the reservoir was filled up to the top, there would not be one drop unfit for human consumption. The quantity, too, was very large—in fact, practically unlimited for the present population. The provision of such a supply was the task they had set themselves to accomplish before they rested satisfied that they had carried out the trust imposed upon them.

The party then broke up, some going to Goring and others to Reading, in the brakes which were in waiting for them.

Proposed Water-Works Extensions at Maryport.—The Maryport Gas and Water Committee have decided to recommend the Urban District Council to apply to Parliament for powers to lay an additional pipe to the mill-race from the Derwent, at the Goat, Cockermouth, and thus double the existing supply, at an estimated cost of £20,000. At present, the water-works yield an annual profit of about £800; so that the proposed additional cutting will, unless more consumers are secured, absorb all the profit. The recommendation was not unanimous; two voting against it, while one was neutral. As an alternative, it was suggested that the town should obtain a gravitation supply from the Dash, a stream flowing from the eastern side of Skiddaw, and so save £800 on pumping from the Derwent. But as this would mean 10 miles more of pipes, and the impounding of the stream at an additional cost of probably not less than £35,000, it was decided to adopt the cheaper scheme.

CHESTERFIELD WATER ARBITRATION.

Riparian Owners' Rights and "Adaptability."

Arbitration proceedings took place on the 17th and 18th inst., at the Surveyors' Institution, Westminster, between Mr. Bernard Lucas and the Chesterfield Gas and Water Board, concerning the compulsory purchase by the latter of certain lands at Linacre, Old Brampton, near Chesterfield, required for the purposes of their water supply. The Umpire was Mr. T. T. Wainwright, the President of the Surveyors' Institution. The Arbitrators were Mr. G. F. Barnes for the claimant, and Mr. F. Fowler for the Board.

Mr. Sutton, K.C., appeared in support of the claim; and Mr. A. C. Acworth, K.C., represented the Board.

Mr. Sutton, in opening, said the question was what compensation should be paid to Mr. Lucas for the purchase of a piece of land, which belonged to him, situated on the Linacre Brook, in the parish of Brampton, lying between the Lower Linacre and the Upper Linacre reservoirs. The embankment of a proposed reservoir crossed the Linacre Brook from Linacre Wood, with the result that the new reservoir would be brought very nearly up to the boundary of what was called the Upper Linacre reservoir. A part of the land down to the brook belonged to them; and it was proposed to take 17 acres 16 perches. The question of what should be paid for this involved considerable difficulty. The land was in itself admirably suited for a reservoir. There was good capacity, a splendid watershed, water of excellent quality, and there was great economy on the site. They had only to build the embankment in the valley, partly on the land belonging to Mr. Lucas and partly on that belonging to the Duke of Devonshire; and they would secure an excellent reservoir. This would not be disputed; but there were difficulties of law, and probably also of fact, arising in this case. The question might be raised, upon the construction of the Acts of Parliament, as to whether it was open to the claimant here to take advantage of what was called the special adaptability, in consequence of the Acts previously passed and the rights under them to the Water Board as successors. He would go through the Acts with a view of seeing what their rights were, and to what extent they in any way prevented the claimant from making the claim that his land had special adaptability for the purposes of a reservoir. When this had been dealt with, there was another question of fact as to value from the special adaptability point of view. The predecessor in title of Mr. Lucas not very long ago sold to the Chesterfield Water Board's predecessor (the Water Company), a small piece of land to lay a line of pipes; and the Duke of Devonshire sold an easement in perpetuity. The reason it was taken to the lower reservoir was that this reservoir, having been made a long time ago, was not at the elevation which more recent building operations and developments in population in the area of supply had made necessary. They no longer gave from the lower reservoir a supply such as was required under the Water-Works Act, or that was necessary for the supply of their area. They therefore wanted to get the water from a higher level; and this was why they laid the pipes. He must therefore first of all point out what it was that the Chesterfield Water Board, as the successors of the Chesterfield Water and Gas Company, acquired—what rights they had in the waters of the Linacre Brook, and what rights, if any, in the land which it was now proposed to take; or what powers and privileges they had in the land which would prevent them in law from using it for the purpose of a reservoir. He ventured to think there were none. The Act under which the powers were first given for the creation of a Water Company was passed in 1825. This was before the importance and value of these water rights had become impressed on the Legislature, as they now were. There were not now so many places available for obtaining a water supply. Important bodies had taken steps to secure to themselves pretty nearly the whole of the watersheds in the country. But this state of things did not exist when the Act was passed; and he found, on looking at the Act, that there was nothing in it to give compensation to any person by reason of his watershed being in any way interfered with. After quoting from the 1825 Act, Counsel said the rights were limited to taking water from a spot a mile-and-a-quarter below the westerly embankment of the Lower Linacre reservoir, and supplying it to such of the inhabitants as might desire to take it. There was no exclusive right of supply, nor any power to do more than take such water as came down to the spot in the Linacre Brook and distribute it. As far as he could make out, there was no provision for giving any compensation to the riparian owners above this point for any loss of rights that they had in the river; the only compensation that was contemplated under the Act was to the riparian owners lower down. It was a curious thing that the Act of Parliament, though it had been repealed, was still the foundation of the rights which the Water Board had in this case. The next Act, passed in 1855, was to enable the Chesterfield Water-Works and Gaslight Company to extend their undertaking and powers and area of supply. Though the Act was repealed, the Company were re-established; and they were put practically in the same position as the old Company had been in, with certain increased powers of supply. They were empowered to make a reservoir; and this reservoir was called the Lower Linacre reservoir. As to the Lower Linacre Brook, there did not appear to be any power given to do more than take the waters that came down to them; and there was no interference with the rights of riparian owners above. The Water-Works Clauses Act of 1847 was incorporated with, and formed part of, the Act; and by the former there would be compensation made for any interference with rights. Then came the Chesterfield Water-Works and Gaslight Company's Act of 1865; and again the Water-Works Clauses Act was included. Power was given to construct new works; but he could not see that there was any authority given over the water that flowed between the two reservoirs, nor was there anything to interfere with the rights of persons who were the owners of the soil. The position seemed to him to be different from any which he had met with in his experience. The Acts were very peculiar, and seemed to be unusual. They had not in any way dealt with the rights of

the riparian owners over the watershed. But they had the right to make the reservoir and to use the waters of the brook; and no doubt the riparian owners could not interfere with the brook so as to prevent the water coming down to the lower reservoir. But so long as they preserved the flow of water to the brook, they could do anything they pleased with the land; and as the brook flowed entirely through the land of the Duke of Devonshire and Mr. Lucas, they could, if they pleased, divert it, not using any of the water, and utilize the land through which the brook previously ran for any purpose. They could not interfere with the flow; they could not take away the water except to such an extent as they were using it, or could use it, at the time when the Act was passed. The Chesterfield Water and Gas Company, by obtaining power to make the reservoir, got no more rights against the riparian owners of the land above than any lower riparian owner would have by common law against an owner higher up the stream. There was no compensation to them. Their rights remained undiminished. They were empowered to construct a reservoir or reservoirs and to receive the waters from the brook without making any compensation to those above.

The UMPIRE: What is the effect of that? Supposing no compensation is, or has been, paid to you. So far as you have gone, these Acts give powers for the taking of these waters. Where have you done with that? Do you mean because you have not got compensation?

Mr. SUTTON said they had not been damnified at present; but the Board were going to damnify them now. What he wanted to show was that they had acquired no rights over their lands beyond those which an ordinary riparian owner lower down had against a riparian owner higher up.

The UMPIRE: It is the usual argument referring to value—the user of the land and consequent value.

Mr. SUTTON said that was so. In 1871 another Act was passed. The increase of population and the increase of commercial works again made the supply inadequate; and under that Act power had been obtained to make an aqueduct or conduit, and a conveyance had been obtained from their predecessor in title. The deed showed that their riparian rights were preserved. Land was sold; but this gave the Board no more rights over the brook than they previously had. The claimant still remained the riparian owner, and the brook could not be interfered with without his consent, except under the Act for making compensation. What he suggested was that if there was land of this description suitable for water-works, and a stream running there—which in itself was valuable—it was a very unusual thing to say that a man's land should be taken at less than £100 an acre, and that he should be cut off from his own stream. It could not be said that they were to take away a man's riparian rights and give him no more than agricultural value. He thought they were entitled to say that, in taking this valuable land, they must pay that reasonable compensation which the riparian owner would expect, and undoubtedly had a right to. The Board had not hitherto deprived them of their riparian rights, but now proposed to do so; and full compensation must be paid.

The UMPIRE: What I am thinking of is this, that no compensation in money has been paid for the stream, but powers have been given to impound the water; and the question is what is the effect.

Mr. SUTTON agreed; but the other side could not prevent the water running down the brook and its being piped away. They had no authority to do this. Their power was limited to laying a pipe and taking it down to the lower reservoir; but they could not take the water away from the brook at the spot. They still preserved their riparian rights. They had no authority to impound; and there was nothing in the Act to show that they might cut off the water from the brook. They might make the reservoir; and the result of this would be that while the reservoir was filling the brook would be dry.

Mr. ACWORTH disputed the fact that the water was bound to come down the brook.

Mr. SUTTON said this was a very difficult and important case; and he could well understand that the Chesterfield Corporation felt it to be very important, and that it perhaps would not be limited to the matter that was at present being discussed. More valuable rights than those in question in this case might depend upon the decision that might be arrived at. In 1894 the demand for water still continued to increase; and it became a question where the Company could get it from. Whether they thought that the area of the watershed where the reservoirs were situated was very valuable, or whether it was that they did not like the situation, he did not know. But instead of going for the purpose of making a reservoir at one place, they went to another brook, a little more to the south (the Hipper Brook); and brought in an Act to take in the waters of the brook and convey them to Chesterfield. The neighbourhood was up in arms. He believed the Chesterfield Corporation, among others, opposed it, with the result that the scheme was thrown out; but upon the condition that the Chesterfield Corporation would buy the undertaking and would themselves provide a sufficient supply for the purposes which the old Company had in view. This was carried out; and in 1895 the Chesterfield Water and Gas Board was formed to take over the old Company, and the area of supply was extended.

Mr. ACWORTH said there was in some sense an extension. In section 38 of the Act there was power to contract for the supply to the Rural District Council. There was not an extension of area; but an extension of the powers of supply.

Mr. SUTTON said that, under section 40, if the Rural District Council wished to do it, they had the right to do it; and if they did not do it, then it would become necessary for the Water Board to do so. It showed that outside the jurisdiction there were other consumers than the Water Board who might be willing. Apparently, in 1904, the Board took steps to increase the supply—the parishes of the Rural District Council not having exercised their option; and among other powers they took the portion of the land belonging to Mr. Lucas. This was what they never had power to do before—"may divert any water which they are now authorized to take, but nothing in the Act shall authorize them to take any water which they are not now authorized to take." It was a most extraordinary section. He presumed it meant that they might take the water of the Linacre Brook and impound it, because they were authorized by previous Acts of Parliament to impound it. He could not see where they were authorized to take the water from the little becks. What was there to prevent the owners of the land through which the brooks flowed making a reservoir to hold the water, provided they sent it on?

The UMPIRE: What about the riparian owner? He cannot dam it up.

Mr. SUTTON said he might utilize it for trade. He wanted to know how the other side contended that they were entitled to take the waters. They were, however, going to do it; and they must therefore pay for it.

Mr. ACWORTH: As I understand, your contention is that we may take the waters of the Linacre Brook, but that you have a right to any tributaries before they reach the brook on the land.

Mr. SUTTON: Yes; but subject to the riparian rights where the waters were flowing. The Board said they could utilize them; but the claimant could utilize them by means of the catchwaters of the watershed. There was nothing to prevent them giving all the water of the Linacre Brook and bringing the water of the watershed into their reservoir. The special adaptability theory did not depend upon the owners of the land being able to carry out the work. It was for the other side to say that they could not make use of the site. It was one of the difficulties about the case that the Board never paid a farthing for this watershed area. No one had ever been benefited; and their contention seemed to be that they would prevent the claimant making use of a valuable watershed by buying this piece of land, which could be made into a reservoir, and paying nothing for the watershed. Another point was that, assuming they could not be allowed to join with others to make the reservoir——

The UMPIRE: I decide at once that you can. If it is requisite, I shall put a clause in my award.

Mr. SUTTON said they had to look to the future. The witnesses he would call would say that they could make a catchwater at the bottom of their land which would be about the middle of the reservoir proposed to be made; and they could drain the area and give a supply of 200,000 gallons a day. There would be no one to say them nay.

The UMPIRE: Only this, that it might cost more money to make a catchwater.

Mr. SUTTON said it could be made. There would be plenty of people who would be entitled to have the water; and they could still do it at a price which would be profitable to them.

Mr. *E. W. Dixon*, a civil engineer, submitted that the following valuation, which he had made jointly with Mr. R. Armistead and Mr. E. Holmes, of lands taken under the Act of 1904, on the basis of the reservoir site: 17·368 acres of land purchased for reservoir site and "surround" at £100 per acre, £1736; add 10 per cent. for compulsory sale, £173; total, £1909. Add proximity value, calculated on a basis of 0·15d. saving in conveyance of water between the watershed and the consumer, equal to 73 million gallons per annum, or an annual value of £55, by thirty years' purchase, equal to £1350. This sum, divided over the 24 acres total area necessary for the reservoir site and surround, is equal to a value of £58 per acre. Claimant's land necessary for part reservoir site, 12 acres, multiplied by £58 per acre, £696; the total claim amounting to £2605. The joint valuation on the catchwater basis of the claim was as follows: 17·368 acres of land purchased for the site of the Middle Linacre reservoir, with "surround," taken at £50 per acre, £868; add 10 per cent. for compulsory sale (£86), £955. Value of water available from 25 acres of watershed between the sites of Nos. 1 and 2 catchwaters, taken at 8 inches of available rainfall per annum, at 2d. per 1000 gallons, equal to £37 10s. annual value, by 30 years' purchase, £1125; additional cost to owner due to increased length of catchwater, 400 yards at £1 10s. (£600), making £1725—total claim, £2680.

Witness was cross-examined respecting his statement that a reservoir could be made privately on the site and water sold at a rate of 6d. or 6½d. per 1000 gallons. He said his suggestion was that this was possible, and that a manufacturer, owing to the scarcity of water, might be found to take from it.

Mr. ACWORTH asked what right there would be to take the water from the riparian owners below.

Witness said he was entitled to such an amount of water as fell upon his own land. He admitted that the scheme suggested would involve obtaining wayleaves from the Duke of Devonshire. He thought for an expenditure of £9000 a water supply on the outskirts of Chesterfield could be made equivalent to a supply of 60,000 gallons a day. This, at 6½d. per 1000 gallons, would pay a hypothetical company or others. He based his calculations as to 6d. upon the Chesterfield Water Act of 1855, which fixed the price for a supply for other than domestic purposes at 8d. per 1000 gallons.

Mr. ACWORTH pointed out that this Act had been repealed, and that at the present time Chesterfield could supply water, if it liked, for such a purpose at 6d. per 1000 gallons; but witness maintained that Chesterfield now required all the available supply from the valley, and that, under these circumstances, they would not be likely to supply water at 6d. per 1000 gallons for commercial purposes.

Mr. *R. Armistead* and Mr. *R. Holmes* gave evidence and submitted valuations similar to that of Mr. Dixon.

Mr. ACWORTH, in opening the case for the Board, said his witnesses would state that the land in question was agricultural land, and had been valued by them on this basis for all practical purposes. The other side had been led away by the idea that they should value it as a water site. The result was that they had not paid as much attention as they otherwise would have done to its agricultural value. It came to the question as to what was the fair agricultural value of the property, treating it as such, and having regard to any injury that might be done to the rest of the agricultural property next to it which was held at present.

Mr. *E. M. Eaton* had known this particular locality for thirty years. He was one of the Consulting Engineers of the old Chesterfield Water and Gas Company, who were taken over in 1895 under an arbitration. He had been called in as Consulting Engineer in reference to this middle reservoir. He had come to the conclusion that the value of the property was an agricultural value. He took it purely on an agricultural basis, and was of opinion that there was no practical basis in this case other than an agricultural basis. The following was his valuation: 8 acres, 1 rood, 5 perches, at £2 per acre, taken at thirty years'

purchase, £495 10s.; 2 acres, 0 rood, 17 perches, at 15s. per acre, at thirty years' purchase, £47 7s. 6d.; 7 acres, 0 rood, 2 perches, woodland, at £15 per acre, £105 3s. 9d., £648 1s. 3d.; add £64 16s. 2d. for compulsory sale—total claim, £712 17s. 5d.

Mr. *E. Lovell Clare* submitted a total valuation of £715 on an agricultural basis; and Mr. *Smith Denton*, a surveyor, of Sheffield, gave evidence to the same effect.

Mr. *J. Middleton*, the Law Clerk to the Water Board, having given formal evidence as to the position of the lands of the Duke of Devonshire and other owners,

Counsel addressed the Court for the parties, and

The UMPIRE announced that the award would be reserved.

GELTSDALE WATER SCHEME.

Question of Compensation to the Earl of Carlisle.

At the Surveyors' Institution on the 20th inst., proceedings were concluded in the arbitration case of the Earl of Carlisle against the Corporation of Carlisle. It was a claim for compensation for depreciation of an estate at Geltsdale, near Carlisle, part of which the Corporation have taken for their water supply. The matter has already proved the subject of a previous arbitration and of proceedings in the High Court.* The Corporation in 1905, under the powers of their Water Act, acquired some four or five acres of land upon the Earl of Carlisle's estate, upon which were some springs, and also a stream. For this, they paid compensation and purchase price. The Earl then claimed compensation for depreciation of his adjoining estate, upon which it was stated that there were four reservoir sites, but that in consequence of the action of the Corporation they had destroyed the water-bearing value of the estate, and a large sum was claimed in consequence. The Umpire was Mr. John Farrer. The Arbitrator for Earl Carlisle was Mr. W. J. Heskett, and for the Corporation Mr. R. Fenwick. After the previous arbitration, Mr. Farrer awarded Earl Carlisle £17,261. The Corporation then took the case to the High Court, on the ground that the Umpire should state separately if he awarded anything for water; and, if so, how much. The Courts referred the matter back to the Umpire to state his award separately in respect of water and depreciation to the estate. The Umpire now had the assistance of a legal assessor in the person of Mr. Williams.

The Hon. J. D. Fitzgerald, K.C., Mr. R. D. Acland, K.C., and Mr. A. Du Cane appeared for the Earl of Carlisle; while Mr. Balfour Browne, K.C., Mr. E. Page, K.C., and Mr. J. G. Wood represented the Corporation.

Evidence was given by Professor Boyd Dawkins, F.R.S., to the effect that reservoirs could be constructed and water properly stored on the Earl of Carlisle's estate at Geltsdale. There were four sites available in the Geltsdale. In cross-examination by Mr. Balfour Browne, witness said he originally selected sites in Geltsdale for the Corporation reservoir; but this was placed elsewhere owing to the ruling of Parliament. Similar evidence was given by Mr. Henry Rofe, M.Inst.C.E. He considered the estate was a valuable water-bearing area. In cross-examination by Mr. Page, he admitted that Earl Carlisle had the same rights as regards underground water that he had before the Act of 1898. He could to-day construct a reservoir on his own land and use the underground waters.

Mr. J. M. Clark was the next witness. He considered the estate was of great value as a water-bearing property; but its value in this respect had been destroyed by the action of the Corporation, as no other authority would be allowed to come there for water now that Carlisle had secured a site in the immediate vicinity. He valued the estate before the Corporation came there at £63,600, and said it had been depreciated to the extent of £22,797. In cross-examination, he said provision was made in the Carlisle Water Act for the Earl of Carlisle to have as much water as he desired for his own use and for agricultural purposes. With regard to his rights in the underground waters, these had not been interfered with. Replying to Mr. Page (for the Corporation), who asked if anybody would give more for it than agricultural value because of the chance of Carlisle coming to it for water, witness said he was sure a purchaser would take that into consideration. He knew of no property that had such a splendid supply of water.

Evidence was then given by Mr. J. T. Wainwright, who said he had considered the great cost to the Earl of Carlisle of getting the water before it reached the stream and the small probability there was that Carlisle would ever require, or be able to utilize, the great quantity of water produced. The effect, however, of their Act had been to add enormously to the cost of the Earl of Carlisle obtaining water if he desired; and it practically kept out other probable customers. The estate, in so far as it was a water-bearing estate, had been for ever sterilized; so that whatever additional value appertained to it through the presence of the underground waters had been abstracted, leaving the estate poorer by £23,000, to which damage he said Earl Carlisle was entitled. He admitted, in answer to Mr. Balfour Browne, that the Earl of Carlisle might, by digging a trench behind the existing springs, tap the underground waters, and could utilize them, if there was any market for them. Mr. Richard Edgar Horsfall gave similar evidence. He estimated the depreciation at £22,000. Replying to Mr. Page, witness said if Carlisle had not obtained their Act, other corporations might have gone there and taken the four reservoir sites available.

Mr. Page, on behalf of the Corporation, said Lord Carlisle could not deprive other riparian owners of their water from the running streams. He had been compensated for his riparian rights, and could not claim any further damage. He called Mr. Mansergh, M.Inst.C.E., who gave evidence to the effect that the Geltsdale was not a suitable place for reservoir construction. The geological conditions were such as to make the construction of reservoirs there very expensive indeed. He thought the Corporation were well advised in going from the Earl of Carlisle's estate to Carrick Castle to erect their reservoirs. He could not conceive any other town coming to the Geltsdale for water. The suggestion that Newcastle might want it was ridiculous. In his opinion, no damage had been sustained to the Earl's estate. The underground water was still his; and he had been compensated for certain riparian rights for the Gelt mill, the sheep wash, and fishing rights. Mr. Charles Hawksley and Professor Kendall gave evidence as to the unsuitability of the Geltsdale for reservoir purposes.

Mr. Balfour Browne, for the Corporation, contended that this was really a claim for water which could not be sustained, and not for depreciation to the estate from any other point of view. The springs had been taken, and did not belong to the Earl of Carlisle. That had been decided in the Court of Appeal. He was not claiming for these, and if he were he was claiming wrongly. His witnesses were in a difficult position. They had before claimed for water at ¼d. per 1000 gallons. But this claim could not be sustained. They were putting it in a different way; but it was nevertheless a real claim for water for which they were not entitled to claim. They had charged for the whole estate at the same rate they had for four reservoir sites, which could not possibly be maintained. If the Corporation had constructed reservoirs on the four sites which had been mentioned, then he thought there would have been evidence that at any rate the sites were suitable, and they could then have claimed their value from them as reservoir sites. The fact, however, that they had gone elsewhere was an indication that these sites were not to be taken into consideration at all, because they were unsuitable. He relied on the evidence that no special adaptability or adaptability at all had been proved; and the Court was bound by the evidence before it, and not by any arguments which might be adduced by his friend. If that were so—and he said it was—then this claim put forward for £22,000 was a new attempt to substantiate the previous claim for loss of water. If so, and if the Umpire was going to award anything for water, then he must ask him to make his award in the shape of a special case, so that he might have it tested in the High Court. The Earl of Carlisle had already received special damages in this case as a riparian owner. But what was meant by this claim for a "water-bearing estate"? If it meant anything, it meant a claim for water underground, which had not yet become the property of the riparian owners. His rights in these had not been interfered with by anything the Corporation had done, and he was not entitled to any compensation for it. Even the claimant's witnesses had admitted this; and so the claim he thought could not be sustained. Counsel also pointed out that no claim with regard to special or any other adaptability could be sustained without it had been shown that there was some competitor in the field, which was not the case here.

The Hon. J. D. Fitzgerald contended that Mr. Balfour Browne had treated the claimant's witnesses unfairly, because, at the first hearing, they had, in estimating the depreciation of the estate, used the unfortunate statement that the water on the estate was valued at ¼d per 1000 gallons. The largest element of value was its capabilities as a water-producing estate; and the Corporation of Carlisle under their Act had taken powers, as a result of which the value of the estate was absolutely gone from the moment the Act was passed and the water virtually became the property of the Corporation. Now that Carlisle had obtained this Act, in the present feeling of the Legislature it was impossible for any other town to come into the valley to avail itself of the water on Lord Carlisle's estate. Their claim was founded purely on fact, and involved two questions. First, was this estate, by reason of its water-bearing and water-storing capabilities, of special value above agricultural or sporting land; and, secondly, had this value been destroyed or depreciated by the exercise by the Corporation of their statutory powers under the Act of 1898? He said both questions, according to the evidence, should be answered in the affirmative; and, under these circumstances, Lord Carlisle was entitled to compensation. He pointed out the exceptional character of the estate as a water-bearing estate. It was not necessary for him to prove that there were competitors in the field for its purchase. It was sufficient for him to state there was a customer; and that that customer was Carlisle. This was decided beyond dispute in the Aspatria case. In conclusion, he asked for suitable compensation for the injury to the estate.

The Umpire reserved his award.

* See "JOURNAL," Vol. XCIII., p. 749, Vol. XCIV., p. 716, Vol. XCVII., p. 831, and Vol. XCVIII., p. 536.

Suicide by Gas.—That deceased committed suicide by inhaling coal gas while of unsound mind, was the verdict of the Coroner's Jury who sat to inquire into the circumstances surrounding the death of Miss Elizabeth Jamieson, aged 61, who died at Halliford House Asylum last Tuesday week. On June 26, she was found sitting in a chair unconscious at her house. The room was full of gas; the tap of the stove being on full, and the windows and door and the grate-register were all closed. She appeared to have recovered from this; but symptoms of insanity set in. The doctor stated that death was due to peritonitis and congestion of the lungs, following poisoning by the inhalation of coal gas.

Cookery Demonstrations at the Cape.—We learn from copies of Cape papers just to hand that, as the result of the activity of Mr. William Arnott, the Manager of the South African Lighting Association, a course of free lectures and demonstrations in cooking by gas was opened in the Loubser Hall, Port Elizabeth, on the 26th ult., when an appropriate address was delivered by Mr. J. C. Kemsley, J.P. He alluded to the intelligent part played by cookery in the school *curriculum* of the present day, and pointed out that the demonstrations were not being given exclusively to display the wares of the Association, but for the special purpose of showing the mothers and girls of Port Elizabeth the best ways of cooking. The first demonstration was then given by Miss Rose Dennis, the Teacher of Cookery in the Cape Town and suburban schools. It occupied close upon two hours, and was followed with the utmost interest by a crowded audience. The Company had freely distributed note-books among the ladies, and full use was made of them. After the lecture, Miss Dennis answered any question arising out of the demonstration; and representatives of the Company were in attendance to furnish particulars in regard to the gas-stoves the Company supply. The second and third lectures were delivered on the 27th and 28th of June; and another series on the 1st, 2nd, and 3rd inst.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

We are under the refreshing influence of the meeting of the North British Association of Gas Managers, held two days ago in Glasgow. It was an important and a successful meeting, giving no indication, in any way whatever, that the Association are affected by the prosperity which has attended the Junior Gas Association in their short existence. A good deal of the time on Thursday was occupied by the business—at times necessary—of putting their house in order. It was even proposed to change the name of the Association, as a sort of sop to patriotic feeling. The proposal, however, was not adopted; the feeling of quite two-thirds of the members present being that no change should be made. Probably the proposal—which, it will be noted, was opposed by the Committee, without giving any reasons—was made in anticipation of the action of the members upon the question of affiliation with the Institution of Gas Engineers. I dare say, if the members had agreed to change the name of the Association, affiliation would have been agreed to without opposition; for it cannot be overlooked that, when this question came to be discussed, the objections to it were not upon the merits, but upon the procedure. Affiliation was agreed to by an overwhelming majority; and then afterwards, through the grace of those who had spoken against it, the resolution was made unanimous. The decision to affiliate was helped very materially by the frank statement made by Mr. W. Doig Gibb, of Newcastle, the President of the Institution. The pity is that Mr. Doig Gibb, being a Scotsman, was not, in consideration of the interesting occasion, made an honorary member of the North British Association; but probably this was overlooked. It may yet be remedied. If there is one point in connection with affiliation on which the North British Association might have been sensitive, but which was not stated by the opponents of affiliation, it was that of precedence. The subject, I suppose, has not yet been considered by the Council of the Institution; but it is a matter which will most probably arise. The North British Association is the oldest of all the affiliated Associations, and, as such, may well claim that their representative should rank next to the President of the Institution on all ceremonial occasions. Such a claim will possibly be disputed by the representatives of larger Associations, on the plea that influence should rank, and not seniority. It would have been better if this question had been settled before affiliation was agreed to. It may be said that there is not much value in position. But there are occasions now and then, such as a reception or a banquet with distinguished people present, when it is of importance; and there are often wrangles, and very bitter ones, over who is to go first in the business. The Association agreed to form a Commercial Section; the decision being officially unanimous, but against the protest of Mr. J. Napier Myers, of Saltcoats. The information regarding the section was conveyed to the members by circular, with the contents of which I am not acquainted. It is to be a separate body, as independent of the North British Association in its working as that Association will be of the Institution—being, in fact, a sort of vassal of the Association. This may account for the fact that all that was done was to resolve that a section be formed; and no arrangements were made for the formation or working of it. The technical matter before the meeting was of quite an interesting nature, bringing into prominence the awakened interest which there now is in the use of retort-house governors, and the methods of extracting naphthalene, which is a new subject of consideration for Scotch gas managers. It is with feelings of regret that the resignation by Mr. R. S. Carlow of the offices of Secretary and Treasurer has been received. Mr. Carlow has devoted himself to the interests of the Association with unflagging zeal, coming up, year after year, with everything in his department in the most perfect order. He has enjoyed the confidence of every President under whom he has served, and has, by each one of them, been praised for his excellent services to the Association, and the assistance he rendered to them. When he quits office, he may be assured that he will carry with him the kindly remembrances and good wishes of all with whom he has come in contact in his official capacity.

The Edinburgh and Leith Gas Commissioners held their usual monthly meeting on Monday last. In the minutes of the special meeting on the previous Monday, it was mentioned that the Engineer had submitted to the Works Committee, on the 15th inst., a statement of the coal proposed to be purchased for the period ending May 15, 1908, and that the Committee recommended acceptance of tenders for 15,000 tons of Newbattle bottoms, 25,000 tons of Edinburgh Hartley, and 10,000 tons of Riggonhead. The Committee recommended that the Engineer should be instructed to negotiate for a modification in price of the other offers which were included in his recommendation, amounting to 44,000 tons, and that he should also receive power to purchase a further quantity of from 6000 to 10,000 tons as required. This is the 94,000 tons purchased on the same date, as stated in these notes last week. The same minute also contained the statement that the Clerk reported to the Committee that, on the instructions of the Sub-Committee, and as advised by Counsel, he had lodged a tender of £4000 in connection with the second action by Messrs. James Muir and Son, Limited; that the offer had been refused; and that thereupon the Committee recommended that the Commissioners should not increase their tender, but should take the award of the Court in the case.

At the meeting last Monday, the Finance and Law Committee reported that they had considered the print abstract of the Commissioners' accounts for the year to Whitsunday last, with the relative notes by the Treasurer upon them, and that, having found the abstract correct, they had resolved to recommend the Commissioners to allow and certify the accounts; to set apart for the annuities sinking fund and the mortgages sinking fund the statutory minimum contributions —viz., £6944 and £11,918; and for the reserve fund £3111, being £2000 beyond the minimum statutory contribution; and to carry forward the balance of £912 to the credit of this year's accounts. The Commissioners approved the accounts.

The Commissioners, without comment, adopted the interesting report by Mr. W. R. Herring, summarized in the "JOURNAL" last Tuesday, on the liability of the Commissioners under the Workmen's Compensation Act. They could scarcely have done otherwise; for a more convincing document could not be conceived. The demonstration that the Commissioners have been able to clear off all their liabilities for accident during the past ten years, by payments which do not amount to more, on the average, than 2s. 9d. per £100 of wages paid, is a significant fact, worthy to be taken into account by owners of gas-works everywhere; and it may go some way towards allaying the undoubted scare which exists at present over the Act.

The Corporation of Elgin are finding trouble over the obtaining of a site for the erection of a new gasholder. There is very great

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 302.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest-ment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Feb. 28	14	Bournemouth Gas and Water 10 p.c.	27½—28½	..	4 18 3
51,810	10	,,	7	Do. B 7 p.c.	16½—17	..	4 2 4
53,200	10	,,	6	Do. Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	,,	12½	Brentford Consolidated	250—255	..	4 18 1
300,000	,,	,,	9½	Do. New	188—193	..	4 18 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	117—122	..	4 2 0
206,250	,,	June 13	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11½	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8½	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41—43	..	4 13 0
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c.	119—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c.	90—93	..	4 16 9
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	11—11½	..	6 1 9
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	25—27*	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	8—9	—½	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord.	109—111	..	4 10 1
1,443,280	Stk.	,,	5 2/10	Commercial 4 p.c Stk.	105—108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	102—105	..	4 15 3
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk.	123—125	..	4 8 0
55,000	,,	Jan.	4	Do. Deb. Stk.	102—104	..	3 16 11
486,090	10	Jan. 31	12†	European, Ltd.	23½—24½	..	4 18 0
354,000	10	,,	12†	Do. £7 10s. paid	18—19	..	4 14 9
15,182,590	Stk.	Feb. 14	4 1/10	Gas-light and Coke 4 p.c. Ord.	95—97	..	4 10 10
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	88—90	..	3 17 9
3,799,735	,,	,,	4	Do. 4 p.c. Con. Pref.	104—107	..	3 14 9
4,193,975	,,	June 13	3	Do. 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	173—176	..	4 10 11
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest-ment.
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A	221—223	..	4 9 8
718,100	,,	,,	7	Do. B.	164—165	..	4 4 10
144,140	Stk.	Feb. 14	7⅝	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Feb. 28	4⅝	Newc'tle & G'tesh'd Con.	108—109	..	4 4 10
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	93½—94½	—¼	3 13 8
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord.	6¾—7¼	..	4 16 7
796,980	5	Jan. 31	5	Do. 5 p.c. Pref.	5—5¼	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	12¾—13¼	..	6 0 9
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	245—247	..	4 1 0
209,984	,,	,,	10	Do. B	245—247	..	4 1 0
523,500	,,	,,	10	Do. C	245—247	..	4 1 0
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,350,000	Stk.	Feb. 14	5½	South Met., 4 p.c. Ord.	120—122	..	4 10 2
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	82—84*	..	3 11 5
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159—161	+2	4 19 5
605,000	Stk.	Feb. 28	5½	S'th Suburb'n Ord. 5 p.c.	117—121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125*	—3	4 0 0
502,310	Stk.	May 15	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Feb. 28	6½	Tottenham and Edmonton A 5 p.c.	123—126	..	5 3 2
398,940	,,	,,	5	Do. B 3½ p.c.	100—103	.	4 17 1
137,500	,,	June 27	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	107—109	+1	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c.	—	..	—
255,636	,,	,,	6½	Do. B 3½ p.c.	131—136	..	4 15 7
75,000	,,	,,	5⅝	Do. C 3½ p.c.	—	..	—
79,416	,,	June 27	3	Do. 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Feb. 28	5⅝	West Ham 5 p.c. Ord.	102—105	..	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div." † Next dividend will be at this rate.

need for a new holder; there being at present storage capacity for only 80,000 cubic feet of gas, while the maximum daily make is now 180,000 cubic feet. The Council had three sites before them last month; and they decided upon one in a part of the town which is thickly peopled. A number of the dwellers there, within the 300 yards radius, held a meeting on the 4th inst., and instructed a Law Agent to lodge a protest with the Town Council against the proposal to erect the holder. The protest was lodged with the Town Clerk, who submitted it to the Town Council at a special meeting lately held. There was a long discussion upon it, in the course of which Bailie Gordon, the Convener of the Gas Committee, urged them to take proceedings before the Sheriff without delay, so that they might get at the work soon. The Council, by eleven votes to five, resolved to lay the matter before the Sheriff, and let him decide for them.

One or two statements of some interest were made by the Chairman at the recent meeting of the Cupar Gas Company, Limited. Although the consumption of gas had increased, the income was somewhat less, which was on account of the resolution to allow 2½d. per 1000 cubic feet discount to consumers who paid £15 and over for gas. Then there was the cost of the show-room they opened some time ago, and which was giving good results. The Manager informed him that he had fixed up no less than 37 gas-cookers. There was also a gratifying increase in prepayment meters. They had actually received £421 through these meters—or 161,040 pennies.

The annual meeting of the Berwick and Tweedmouth Gas Company was held on Wednesday, the 17th inst.—Mr. George S. Riddle in the chair. The Directors reported that the business of the Company was going steadily on. An exhibition was held in April. Owing to the great and unprecedented advance in the price of coal, as also in the price of other materials used in gas manufacture, they had been compelled to advance the price of gas from 3s. 7d. to 3s. 11d. per 1000 cubic feet. The net profit realized was £1157. The Directors recommended a dividend of 10 per cent., free of income-tax. The total income was £6583; and the expenditure amounted to £5426. At the present time the number of consumers and the quantity of gas sold were higher than they had ever been in the history of the Company. The Chairman proposed a vote of thanks to the Secretary, the Manager, and the other officials. The report was adopted, and the vote agreed to.

The annual business meeting of the Bo'ness Gaslight Company was held on Monday—ex-Provost Ballantine presiding. The report of the Directors showed that the quantity of gas manufactured was 24,905,600 cubic feet—an increase upon the previous year of 481,000 cubic feet. The usual dividend of 5 per cent. was declared, and a substantial sum carried forward. It was reported that the contracts for coal which had been entered into were at the rate of 13s. 5d. per ton, as compared with 8s. 9d., which would represent to the Company a difference of £550 for the year.

A Parliamentary Commission is at present sitting in Edinburgh for the consideration of a group of applications for Provisional Orders under the Private Bill Procedure (Scotland) Act, 1899. On Tuesday they had before them an application by the Edinburgh and District Water Trust, who wish additional powers: (1) To construct filters and other subsidiary works; (2) to define the limit of height to which the Trustees may be required to supply water; (3) to continue the line of railway laid down from Broughton Station to Talla, during the construction of the works; (4) to grant retiring allowances to officials; and (5) to alter the provisions with reference to the sinking fund. There was no opposition to any of the proposals, with the exception of that relating to the railway, as to which, Sir Basil Montgomery, of Stanhope, wished it removed. The purpose for which the railway was constructed, he maintained, was served when the Talla works were completed, and its continuance was a menace to the amenities of his property. For the Trustees, it was contended that the railway cost £60,000; and as the Trustees had power to take in water from other watersheds than the Talla, and might require to use that power, the railway would then be needed. The Commission approved the preamble of the Order, with conditions to protect the interests of Sir Basil Montgomery. His property is approached by a level crossing. It was part of his proposal that a bridge should be erected; but the cost of this, it was pointed out, in reply, would be not less than £2360. The Commission have allowed the level-crossing to remain.

The St. Andrews Town Council held a special meeting on Monday to consider as to the adoption of a scheme for the augmentation of the town's water supply. The meeting was held under compulsion from the Local Government Board, from whom a communication had been received, to the effect that if a plebiscite of the ratepayers were to be taken, they wished the Town Council to give an undertaking that one of the schemes before the Council would be proceeded with immediately thereafter. The Council had, however, replied to this communication that it would not be convenient to take the plebiscite till the end of September. There are five schemes before the Council. A letter was read from the Local Government Board, agreeing not to take action against the Council till after the end of September. Then the Council discussed the situation; the feeling being one of resentment at the threatened action of the Local Government Board, which, it was conceived, proceeded upon the assumption that the Council were defaulters. In the end, the Council selected three of the schemes to be laid before the ratepayers; the favourite one being Lumbo Den, the cost of which is estimated at £13,321.

Colwyn Bay Water Supply.—In the House of Commons on Monday last week, Mr. Weir asked the President of the Local Government Board whether, seeing that the Colwyn Bay Urban District Council now realize that the water supply is insufficient, he would ascertain if any steps were being taken to augment the supply, especially in view of the increased demand for water during the holiday season. Mr. Burns, in reply, said the district was supplied with water by the Conway and Colwyn Bay Joint Water Supply Board. The District Council, who were one of the constituent authorities of the Board, had for some time been pressing them to lay an additional main from the intake in Lake Cowlyd, so as to supply more water into the constituent districts; and about a week ago the Board resolved to seek powers next session to take more water from the lake.

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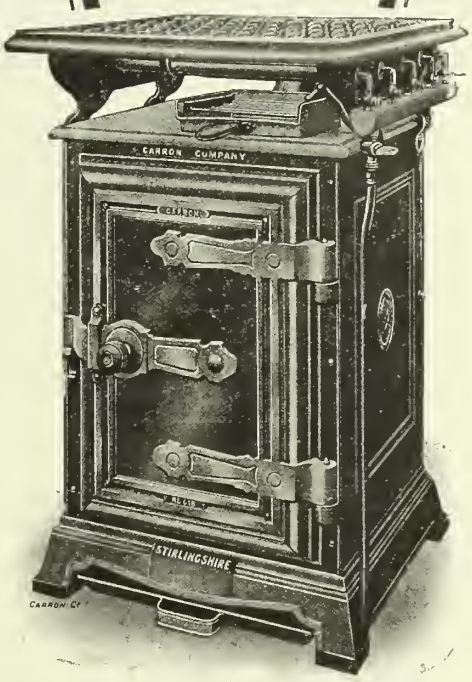

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CURRENT SALES OF GAS PRODUCTS.

Week ending July 27.

The London market for tar products remains in a steady position. There is, of course, the customary restriction of business at the holiday season. The shipment of pitch will restart in September; and more activity in this article may be then expected. Creosote oil is scarce; and 3d. to 3¼d. would have to be paid for a good make. A large shipment of this oil has lately taken place, and the quantity left in makers' stores is low; the local demand being also good. Benzol is daily finding new customers among motorists; and it is quite possible that the recently published report of the Committee of the Motor Union, recommending the use of benzol for motor purposes, will call for inquiry for the article. There is no alteration in the value of sulphate of ammonia, which may be put at £12, on Beckton terms.

Sulphate of Ammonia. LIVERPOOL, *July* 27.

The market has been somewhat irregular, for while in some cases prices below the level of current quotations have been accepted, in urgent cases full prices have been paid. On the whole, there has not been much change in actual values, though at the close the tone is quiet, the month's requirements being covered, with quotations at £11 13s. 9d. per ton f.ob. Hull, £11 16s. 3d. to £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has been further speculative selling in the forward position at about the level of spot prices; but makers for the most part are firm at a premium of 2s. 6d. to 5s. per ton, according to position.

Nitrate of Soda.

This market is quiet but steady, with spot prices at 11s. to 11s. 3d. per cwt., according to quality.

Tar Products. LONDON, *July* 27.

Things remain unchanged; and there does not appear to be any chance of increased business at present. Pitch is quiet. There is no business doing for prompt delivery; while for forward, dealers are unable to pay manufacturers' prices, owing to there being very little inquiry from the Continent. Creosote is still fairly firm, and makers are not anxious to sell for any length of time forward. There is no change in carbolic acid. Continental consumers will not make any increase on their recent offers. The prices of crystals are unaltered. Benzol, 90 per cent., remains unchanged, both for prompt and forward delivery. No business is reported in 50 to 90 per cent. benzol and toluol. Prices of solvent naphtha remain about the same in the North; but in London, makers' ideas are rather firmer for forward delivery.

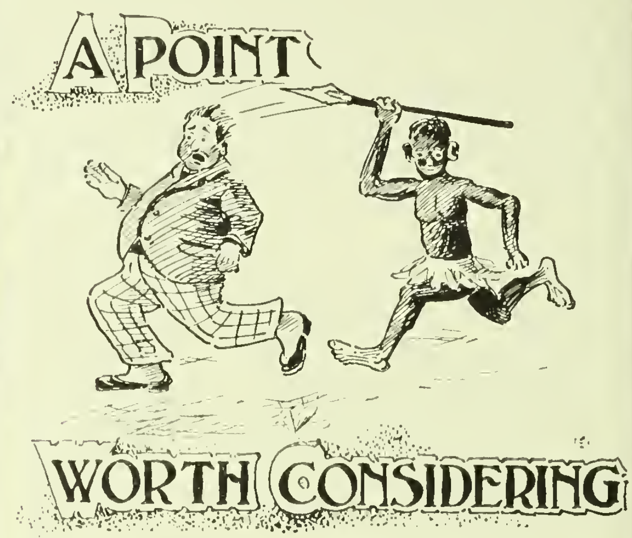
The average values during the week were: Tar, 15s. 6d. to 20s. Pitch, London, 26s. nominal; east coast, 25s. to 25s. 6d.; west coast, 23s. 9d. to 24s. 6d. Benzol, 90 per cent., 7½d. to 8½d.; 50-90 per cent., 8¼d. to 9¼d. Toluol, 10¾d. to 11½d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. to 1s. 2¼d.; heavy naphtha, 1s. 1½d. to 1s. 3½d. Creosote, London, 2⅞d. to 3d.; North, 2½d. to 2¾d. Heavy oils, 3d. to 3¼d. Carbolic acid, 60 per cent., 1s. 7½d. to 1s. 7¾d. Naphthalene, £6 to £12. Anthracene, "A" quality, 1½d. to 1¾d.

Sulphate of Ammonia.

This article is unchanged, and practically no business is reported. The principal London Gas Companies still ask £12 2s. 6d. to £12 5s. for forward; and the price for prompt may be taken at £12 1s. 3d. Ordinary London makes remain unchanged at £11 13s. 9d. to £11 15s. The price at Leith is £12 to £12 2s. 6d.; Liverpool, £11 16s. 3d. to £11 17s. 6d.; and Hull, £11 15s.

Travelling Expenses of Local Authorities.—Last Thursday, the President of the Local Government Board replied to a question on the above subject put to him by Mr. Rogers, the Member for Devizes. It was whether instructions were given by the Board to their Auditors to allow or to surcharge payment by a county council or any other local authority of the reasonable travelling expenses of the members when engaged in the business of such council or authority. Mr. Burns said no instructions had been given by the Board on the subject. He was, however, advised that, looking to the decision of the High Court in the case of *Rex v. Dolby*, a local authority were in general not empowered to pay the travelling expenses of members of their body when engaged on the ordinary business of the authority within the district. This view would, he said, apply to county councils as well as to other local authorities.

Carlisle Gas and Water Supply.—In his report to the Finance Committee for the year ending March 31, Mr. John Graham, the City Treasurer of Carlisle, says the total income on gas-works revenue account was £44,836, against £45,795 the previous year, a decrease of £959. This is mainly to be accounted for in the decreased amount received from the sale of tar, sulphate, and coke. The sale of gas shows an increase of £49. The expenditure amounted to £32,229, or a decrease of £1188. The largest item in this decrease is the cost of coal, which, on the year's working, shows a diminution of £684. The gross profit for the year amounts to £12,606; and after paying £593 for income-tax, £2731 instalment of loans, £1123 interest on loans, £120 interest on deposits, £170 bank interest, and the usual £1000 in respect of the contribution towards the cost of the water-gas plant, the net profit is £6869, which is slightly less than last year. The water-works account shows a very satisfactory state of affairs. The expenditure on revenue has diminished about £210, while the income has considerably increased. In this year's account the fixed charges have been taken to March 31 instead of June 30 as heretofore. Had a full year's income from all sources been shown, it would have amounted to £14,615, or nearly £1800 in excess of the previous year. The gross profits amount to £8338; and after payment of income-tax, instalment and interest on loans, and the debit balance on the baths account for the previous year, a net available surplus of £6693 is arrived at.



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COAL TRADE REPORTS.

Lancashire Coal Trade.

There is little change to record in the coal industry of Lancashire. The warmer weather has brought about a lull in house qualities; but no reduction in prices. Owing to the Belfast strike, less coal has been exported to Ireland and more thrown upon the home market, but not in sufficient quantities to weaken existing rates. Furnace coal and coke continue to sell well. Gas coal and cannel are in very small demand. A new discovery of coal is reported from the neighbourhood of the Cheviot Hills. Less trouble is noticeable in the railway coal-waggon department. The general quotations are unaltered.

Northern Coal Trade.

There has been some further enlargement in the demand for steam coals. The market seems now to be brisk, with heavier exports and some tendency to higher prices for fuel generally. For best Northumbrian steams, the quotation has risen to 15s. 3d. to 15s. 6d. per ton f.o.b., second-class steams are 14s. 3d. to 14s. 6d., and steam smalls seem rather less scarce at 10s. to 10s. 3d. Work at the collieries seems to be brisk; and the heavy production is readily taken up by the demand. In the gas coal trade, there is a slow growth in the home consumption; and the exports are now very heavy. As to prices, Durham gas coal varies from about 13s. 6d. to 14s. 9d. per ton f.o.b. There are more contracts in course of negotiation, especially for export; and in one case about 40,000 tons have been sold for delivery to a French port, at a price that is believed to leave about 13s. 4½d. per ton f.o.b. A contract for Denmark is also spoken of as settled at near the same price. Other inquiries for gas coal, including additional quantities for the Metropolis, are believed to be in treaty. Coke is very steady, and gas coke for export is rather scarce. The limited production, coupled with dearer coal, has stiffened the price of gas coke, which is quoted at from about 17s. to 17s. 6d. per ton f.o.b.

Scotch Coal Trade.

Trade remains brisk, especially the foreign part of it. The miners have not yet fully resumed work, with the consequence that outputs are being promptly taken up, and, in fact, are not equal to the demand. The prices quoted are: Ell, 12s. 6d. to 14s. per ton f.o.b. Glasgow, splint 13s. to 13s. 6d., and steam 12s. 3d. to 12s. 6d. The shipments for the week amounted to 182,935 tons—a decrease upon the previous week of 130,382 tons, but an increase on the corresponding week of 1758 tons. For the year to date, the total shipments have been 7,881,421 tons—an increase upon the corresponding period of 475,424 tons.

It is reported that the North Cheshire Water Company, who serve the Altrincham district, have decided to reduce their charge for garden hose-pipes to half the usual amount, in consequence of the exceptionally wet season.

The 400 additional £10 "B" shares in the Eastbourne Gas Company for which tenders were recently invited realized £10,503 19s. 6d.; being at the rate of more than £26 5s. per share. The issue was subscribed for nearly twice over.

Messrs. S. Wolf and Co., of No. 138, Southwark Street, S.E., have issued a new catalogue of their portable electric drilling and grinding machines. On p. 17 (fig. 4) is shown a hand grinding and polishing machine for operating on work *in situ*.

The Public Control Committee of the London County Council report that last month 19,505 gas-meters were sent in to the Inspectors for testing. Of these, 17,320 were stamped and 2185 were rejected. The fees received amounted to £553 15s. 6d.

Tenders for the issue of 600 ordinary shares of £10 each of and in the East Surrey Water Company were opened on Friday. They amounted to £9946, at prices ranging from £16 10s. to £16 15s. per share. The average price obtained was £16 11s. 6d. per share.

The Directors of the South Staffordshire Water-Works Company have decided (subject to the examination of the accounts by the Auditors) to recommend the declaration of a dividend for the half year to June 30, on the ordinary stock, at the rate of 7 per cent. per annum less income-tax. This will leave a balance of £7593 to be carried forward.

The Ashford Urban District Council, at their last monthly meeting, voluntarily decided to increase by £70 per annum the salary of their Gas Engineer and Manager (Mr. Herbert R. Turner), in order to show their appreciation of his first year's service, and for the extra work devolving upon him in carrying out the extensions of a bench of regenerative settings and the carburetted water-gas plant.

Last Friday evening, there was a burst in the main which carries the water from the Elan Valley to Birmingham, at a point known as the Old Quarry, situated on Monument Hill, Hagley, near Stourbridge. The water rushed down the hillside, and flooded several cottages. It eventually found its way into the Birmingham Road, down which it poured in torrents, making traffic impossible, and cutting up the road badly. The water continued to flow for nearly 40 minutes before it could be cut off.

It is reported that a remarkable case of water finding has been achieved by Mr. H. Chesterman, of Bath and Hereford, at Brickiln Farm, Burghill, Hereford. Mr. Chesterman having been called in to locate water for general farm use, he stated that a good supply would be found at a depth of 65 feet. The spring was tapped at 68 feet, and rose to within 9 feet of the surface. The test pumping showed a yield of not less than 15,000 gallons per day from a 6-inch artesian tube well, which was sunk on the condition of "no water no pay."

The employees in the stove and meter departments of the Portsea Island Gas Company recently had their annual outing, followed by a smoking concert. Last Wednesday, the officials and workmen of the Ventnor Gas and Water Company, accompanied by the Chairman (Mr. W. H. Littlefield) and the Engineer and Secretary (Mr. J. S. Ineson), had an excursion to Freshwater, where they dined at Starke's Hotel. After dinner, Mr. Littlefield and Mr. Ineson were each presented with a silver-mounted pipe in a case. The return journey was by way of Carisbrooke, where tea was partaken of.

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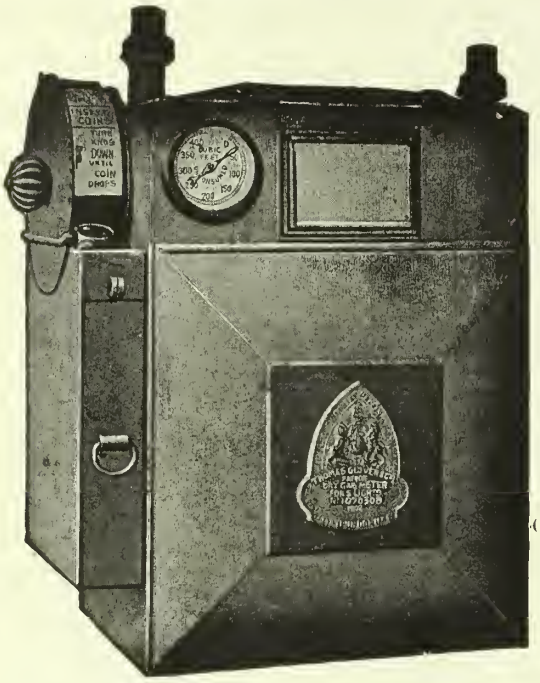

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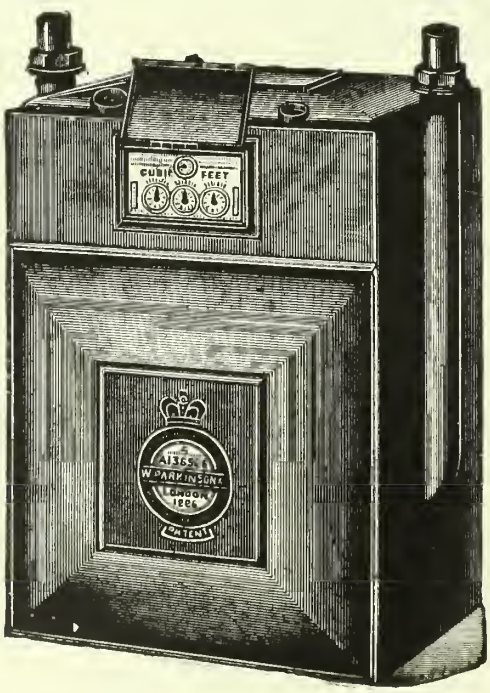

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VOL. XCIX., No. 2308.—TUESDAY, AUGUST 6, 1907.

EDITORIAL NOTES—GAS, &c.

A Contented Gaslight Proprietary.

THE spirit of contentment brooded over the meeting of the Gaslight and Coke Company on Friday, so much so that the attitude of the greater number of proprietors was almost one of listlessness. The Governor (Mr. Corbet Woodall) was modest in relating the tale of the continued improvement in the condition of the Company's affairs generally. In quite matter-of-fact style, he pointed to the principal of the tangible financial accretions; and if there is one fault to be found with him, it is that he did not sufficiently emphasize how much better the net result would have looked had the wise and liberal policy of the Board in respect of charges upon revenue account in connection with upkeep and depreciation been kept within narrower limits. But we know the breadth of the Governor's view in this matter; and what is characterized here as "liberal policy" is doubtless, in his estimation, only what should be described as something like normal, having regard to the extent of plant and appliances and the obligations of the Directors and the Company. But if such a liberal policy continues, united to the operation of the redemption fund, and the higher manufacturing results from plant and material, we confidently believe it will be found that the effect will be so soon impressed on the capital employed, and the amount required for interest and dividend, per million cubic feet of gas sold, that the proprietors and the Stock Exchange will not be long in properly appreciating what this course of events implies for the future of the concern. Taking the last half year only, the net addition to the capital account was the (comparatively speaking) trifling amount of £872; and the increase in the sale of gas was about 352 millions. These are significant figures. The Governor looks upon the increase of $3\frac{1}{4}$ per cent. in the consumption of gas as "the most satisfactory "feature" in the report. Commercially, that may be so; but technically in our opinion the result in cost and yield of the manufacturing operations may justly stand as a claimant for equality in descriptive distinction. However, on the accounts as a whole there was accord among the proprietors as to the improvement in healthy state, as to prosperity and prospects, and as to the vigorous and co-operative action that has contributed to the bringing of these things to pass.

The Governor made passing, but deservedly generous, recognition of the benefits that are accruing from the scheme of technical instruction for the staff officers and employees. It is sufficient that the education thus afforded is advantageous in the intellectual improvement of the employees, and in the primary purpose of the scheme of raising the level of competence and efficiency in treating with customers and work. But there are important secondary advantages, in that by examination the men are able to gain distinction, and the Board are thus in a position to promote according to merit rather than by that most unsatisfactory and misleading guide—favour.

This purely domestic matter (which, however, should be an object-lesson to gas administrators generally) was the connecting link in the Governor's address between present financial position and future prospects. Naturally, the coal question is one that is too momentous to be avoided at this time in any address from the chair of a Gas Company. As previously pointed out, the increased cost of raw material to the Company in the current year represents the heavy strain on the business of no less a sum than £250,000; but it is a gratifying piece of intelligence that it is the deliberate view of the Governor and his colleagues that, by the aid of the £60,000 or thereabouts to be derived from reimposing meter-rents, the income of the coming twelve months will "probably" meet the expenditure. We devoutly hope that it will be so, and that, by the time the next coal contracts have to be negotiated, there will be a turn in the coal market, and easier prices. It is all a matter for speculation as to the future of coal prices. The prophets are busy, but unreliable. If omens have any greater weight on one side than another, they do not give hope of a speedy issue out of the present affliction for industry. No one can tell what will happen; but the general feeling is that the day is distant when the old prices will again obtain. Revived business in home manufacture is not the only cause underlying the present high prices. If it were, there would be some reason for thankfulness. The great increase in coal sales for abroad, the difficulty of obtaining deliveries over railways and through congested ports—a difficulty accentuated by the increase in coal exports—and the concurrent tightening of the screw by the railway companies, are all disturbing factors; and there are the prospective disconcerting ones of legislative interference between coalmaster and man. The extreme free traders still laugh at the allegation that the removal of the coal tax has anything to do with the present perversity in the coal market. There are as good free traders who hold a contrary opinion. No one can accuse Sir George Livesey and Mr. Corbet Woodall of being Protectionists; but their opinion is that the removal of the coal tax was not justified, and has not been justified by events. Lord Claud Hamilton, at the meeting of the Great Eastern Railway Company last week, made a like declaration. The thing, however, has been done; and we have perforce to make the best of the present conditions. So far as the Gaslight and Coke Company are concerned, and they are not alone in this, the heavy tax of the increased coal price has deferred the hope of the Board of making a reduction in the charges for gas.

Mingled with other points bearing upon prospects, the Governor had something to say regarding the restoration of meter-rents, the removal of which, as we have recently hinted, he regards as having been a blunder, in view of the change having been made by the Company alone in London. Yet another subject was that of smokeless fuel. The Company are willing, ready, aye and are already supplying the fuel which they have designated "Carbo;" and next winter, the Governor states, they will be doing quite a large business in it. We do not know what the Coalite people will say to this, or whether they will round off an insane idea of proceeding for an infringement of patents through the Company having taken it into their heads to do part of their carbonization at somewhat lower temperatures than are now ordinarily employed in gas-making, and for exposing the charges to those temperatures for a shorter length of time. There has not been much heard of the Coalite Company since they exhibited to the public an inordinate desire to handle its money in bulk. Why are their glowing advertisement-articles dropped, why have the demonstrations of coalite in hotel basements ceased, and why have several things that happened prior to the issue of the prospectus not been continued? Why the silence? This is digression, but it arises out of the Governor's statement that next winter in the new branch of their business—that is to say the "Carbo" branch—they will be doing quite a large trade. That was not the least of the interesting matters introduced to the notice of a satisfied proprietary on Friday.

South Metropolitan Report and Accounts.

To those not directly engaged in the management and work of the South Metropolitan Gas Company, interest in its affairs rests for the moment rather in the future than in the immediate past, in view of the increase by 3d. in the price of gas from Midsummer and the advance in the cost of coal. The report and the statement of accounts which Sir George Livesey and his colleagues have issued brings to a close—temporarily only, it is hoped—the history of the Company under a 2s. price. It has been a history with disappointments and of unfulfilled expectations, and just as the financial equilibrium has been established, it is again upset by circumstances so falling that the coalowners are placed in a position

in which they can size-up their own demands, and largely enforce them. Scrutinizing the accounts before us, there is not the slightest doubt that had it not been for the contumacious conditions in the coal market, the Company would have been able to have declared that they had fairly "turned "the corner" under the low price for London of 2s. per 1000 cubic feet, and that the business was well capable of sustaining that price. But the position has been changed, and there is no help for it but to make the best of it, as the South Metropolitan Company will do from the Chairman to the humblest of the active co-partners in the concern. While the consumers suffer the increase in price, the proprietors will have the dividend they have been receiving (which has not been of the full statutory amount) reduced by 3s. 4d. per cent., and the bonus of the employees will fall from $9\frac{3}{4}$ to $7\frac{1}{2}$ per cent., or from £45,000 to £35,000. The report, which is signed by the Chairman, mentions that all the parties interested are thus partners in adversity as well as in prosperity. However true that may be, there is an inequality in the burden of responsibility and anxiety in the times of adversity; but, of course, there are no possible ways or means by which this can be rectified. But the consumers have it within their power to do something in an endeavour to show Parliament that, in any future steps taken to create and shape new situations in the coal industry which may have a tendency to perpetuate higher prices for coal, they, as gas and coal consumers, have a right to consideration. In their report the Directors point out what is in the legislative programme in this direction; and we have it submitted that "if the users of coal—that is everybody—forgetting that "everybody's business is nobody's business, do not press "their claims on Parliament, in opposition to the efforts of "interested parties and faddists, the position is in great "danger of going by default." That is the most suggestive point in this characteristically plain-spoken document.

The higher price of coal touched the business of the past half year; but fortunately about three-quarters of the coal carbonized was delivered under former contracts. The increased expenditure under this head was £51,033; but there was an additional 19,717 tons of coal carbonized, to meet the increased sale of gas. The gas business put on to its substantial dimensions about 147 million cubic feet, which is highly satisfactory, considering the reduction brought about by the incandescent gas-burner. We mention this now somewhat trite matter, because it is observed that, though some 377 additional street-lamps have been erected in the Company's area, the consumption of gas for public lighting in the half year compared with the corresponding period of 1906 is not far short of 67 millions less. But we also see that out of a total of 23,293 public lamps in the Company's district, there are now only 15 of the flat-flame species—no less than 888 flat-flame lamps having gone the way that such inefficient (under the new order of things) lamps must go.

The accounts really do not give much scope for general comment. On the expenditure side of the statement as to revenue, coal is the only item exhibiting any substantial variation from last year. There were decreases in four of the five items covering repairs, maintenance, and renewals under manufacture and distribution, and on balance we have a charge for these purposes of between £9000 and £10,000 less than twelve months ago. The total expenditure was £49,195 more; but, notwithstanding, the balance carried to net revenue account is nearly £12,000 greater. The residuals have done excellently in contributing to this result, for as a matter of fact the increase (£41,207) in the income from this source, was only short of the extra amount paid for coal by £9826. Coke was by far the best contributor to the higher income, with an excess of £30,806 upon the returns for the first six months of last year. But next to coke, gas, at the old price of 2s., gave an increase of £16,444; and altogether the total income came out £61,150 better than a year ago. The general result is that the deficiency of £9364 on the December accounts has been made good; and there is a small balance, after meeting all charges, to be carried forward. There is nothing to complain about in this financial condition. It is excellent with the low price of gas; and with such increases as nearly 15,000 in the number of prepayment consumers, of more than 12,000 in stoves, and nearly 1400 in gas-fires, the prospect of a continuance of advancing consumption—the increase in price notwithstanding—is assured, as far as it is possible to assure it, in the best manner. The prepayment meter consumers, it may be noted as a point of interest, now number 212,945, which is double that of the ordinary consumers, with 11,411 in excess. There are other matters in the report, such as the absurdities surrounding the rating system, which will give the Chairman matter upon which to expatiate when he meets the proprietors to-morrow week.

Glasgow Corporation Gas Affairs.

It is with feelings of no ordinary pleasure that we lay before our readers this week the accounts of the Gas Department of the Glasgow Town Council, for they present a measure of success which, while it must be gratifying to all concerned, is no less so to everyone who takes an interest in gas matters. The financing of the undertaking is a matter of some complexity, but it is getting simpler as the years go by. There are two classes of debt—annuities and corporation loans—and each of these again consists of two branches. The annuities have been from the beginning of two values, the one at 9 and the other at $6\frac{3}{4}$ per cent. The loans are obtained from the Corporation at the rate of £3 5s. 9d. per cent.; and there is, in addition, a class of 3 per cent. stock, into which a number of the annuities have been converted. There have been no mortgages over the works for ten years—the cheaper method having been adopted of procuring money from the Corporation as bankers; so that not only do the Gas Committee secure money at a low rate of interest, but the machinery for obtaining it is simple and inexpensive. This enables easy working. The train of thought need not be pursued farther; but it may be noted that corporation loans have already been redeemed out of the sinking fund to the amount of £443,363, while from the same fund payments have been made for the redemption of annuities to the amount of £55,482; and, in addition, depreciation has been provided out of revenues to the extent of £1,347,142.

These figures illustrate the vastness of the financial transactions controlled by those at the head of affairs; but it is in the results obtained in the works department that the great vitality of the business will be best understood. An increased output of gas for the year of 250 million cubic feet, is quite a striking feature in itself. It is greater than the annual output in every town in Scotland excepting Edinburgh, Dundee, Aberdeen, Paisley, and Greenock. Yet it followed upon a similar increase the year before. It may not be out of place to recall here that two years ago the Corporation reduced the illuminating power of the gas from 20 to 18 candles; and that whereas in previous years increases of 50 million cubic feet and over were not uncommon, the lower quality gas has, so far, been accompanied by a much larger demand for it. While this comment lies on the surface, it is not to be lost sight of that two years ago also synchronizes with the granting of a concession of 3d. per 1000 cubic feet for gas used in gas-engines and for manufacturing purposes, following which, the report of the Committee bears out, there has been an augmented demand for gas for these purposes amounting to nearly 90 million cubic feet. So that the assumption is by no means warranted that the increased demand for gas is due to consumers requiring to use more of it in order to obtain light. One factor in the situation is sufficient to lay any such thought aside—namely, the greatly extended use of incandescent burners. It follows that the increased consumption of gas must be accounted for by other causes; and in its being found that the gas is used by traders there can only be satisfaction in the thought that the beneficent action of the Corporation has been so handsomely responded to by the traders in the city. Another source of increase was dwelt upon by Mr. T. Calderwood, the able Convener of the Gas Committee. This is to be found in the great expansion of business through the use of prepayment meters. The Corporation are very wisely not pushing these, as hitherto, at the rates charged; there has not been much profit upon the gas sold through them. An extra charge of 5d. per 1000 cubic feet has not sufficed to make prepayment meters profitable in Glasgow. The difference has consequently been increased to 7d., which is considered by Mr. Wilson, the Engineer, to be about the figure which will make the account square. The Gas Committee are fully aware of the enhanced cost of working prepayment meters, and that a considerable proportion of this enhancement lies in the disposition there is on the part of consumers who contribute the least to the revenue to have ordinary meters substituted by prepayment ones. Therefore the Committee are to present a firm front

to applicants, unless these be for the fitting-up of a whole tenement—when, of course, it might be good policy (there being no sacrifice to begin with) to stretch a point in order to keep out other illuminants. There may be the other consideration with the Committee that they have pretty well saturated the community with this form of meter, and that, having secured a business which now amounts to some 167 million cubic feet a year, there is not much call upon them to go farther in the same direction.

The Gas Committee have entered into new contracts for the disposal of the residual products at Dawsholm and Tradeston, from which better results are anticipated. These might be expected to follow, in due course, from the increased cost of coal; but another element may probably be found in competition leading to an improvement in the offers received. One effect of the very large increase in the consumption of gas is found in the fact that the Gas Committee are already applying their minds to the question of extending the gas-works at Provan, in the first section of which gas was begun to be made in July, 1904. Nothing has yet been settled in connection with this extension. The Corporation have, however, appointed a deputation of two members of the Committee, with the Engineer, to visit places where vertical retorts are to be seen at work. This will secure that the form of retorts named will not be overlooked when the time comes for consideration of details; and from the manner the gas-works in Glasgow have hitherto been thrown open to everything which was most up-to-date, there may be the fullest and freest anticipation that vertical retorts, if their merits stand investigation, will not be denied an opportunity on the banks of the Clyde of showing what they are capable of doing.

A Pernicious Lighting Scheme Strangled.

The inspection and revision of the Progressive management of local affairs in London are bringing to light a great deal of false representation, especially in matters electrical. The Woolwich imbroglio is a case in point; another the misleading but plausible invention which had for its design the supplementing of the public lighting business of the Islington Electricity Department by displacing by electricity 714 incandescent gas-lamps. It was high time that a party was placed in power competent to overhaul and revise the deeds and plans of the ambitious and impetuous Progressives, whose principle of action is to live for the present and allow the future to take care of itself. It was a big public lighting scheme—big, but yet only the beginning of a still more stupendous project—that the Progressives tried to force through at Islington last year; and while they affected to show ratepayers that there would be financial advantage in the project, the ratepayers were shy—having had experience of what electric lighting had done for them in increasing the public lighting account—and asked among themselves whether there was not something behind the fair report that they received. There was something behind it; and it was the loading of the electricity undertaking with an amount of capital that a careful scrutiny (by a Special Committee appointed last December) of the affairs of the concern and the prospects of the scheme has disclosed, could not possibly be remunerative. The decision of the Progressives was heralded with a shrill fanfare by the newspapers of their political colour. But they have made less noise over the exposure of the highly embellished reports of last year. The Special Committee aver that "the scheme was ill-conceived, and, if "carried out, would be detrimental to the interests of the "borough." The same could be said of many another scheme of public electric lighting that has been carried out. We have failed to detect that cities and towns and the people have exhibited any improved tendencies as the result of the great additional annual expenditure to which they have been subjected on this score. In the case of Islington, the Special Committee have arrived at their determination that the scheme should be dropped, in face of the fact that a substantial amount of the material required for it has been purchased. They prefer at once to make a clean cut of losses; and their preference has been established by a vote of 37 in favour against the unlucky number of 13 in opposition. The figures in the Committee's report are well worth looking into; and they will be found in our "Miscellaneous "News." Among other things, it will be remarked that 101 miles of streets are "well lit" with incandescent gas-burners at a cost of £160 per mile, against £810 per mile for electricity. The Committee let the "cat out of the bag" in pointing out that this was only the beginning of a Progressive scheme for lighting the whole borough by electricity, at a cost of a quarter of a million. Of such are Progressive notions of economical and efficient local government.

Electricity a Gas-Works Bye-Product.

What is the true scope of a gas-works, asks Herr Kobbert, of Königsberg, in the paper he read at the last meeting of the German Association of Gas Engineers; and his own answer is that the border-line of scope will not be reached until the gas-works becomes in verity, as well as in name, the central station of city or town for light, heat, and power. Then, and not till then, will the gas-works fulfil its destiny. If we keep Herr Kobbert's ideal before us, there will certainly never be any feeling of space being restricted within which to exercise energy. Economical considerations, in his view, demand that no coal shall be burned for any purpose whatever within the confines of city or suburbs; but that it shall all be dealt with first at the gas-works—the products only being utilized for light, heat, or power. Even where electricity is employed as the illuminating agent, the current should, in his opinion, really be a product of the gas maker. The incurious may pass with a laugh the idea of electricity being in the nature of a product (or a bye-product, rather), of a gas-works; but there is a case in England where it is seriously so considered. We cannot, of course, except so far as the merits of gas and the means of utilization will carry us, control the whims and fancies of other people, in regard to light, heat, and power. There are some who will have electricity for one, two, or all three purposes; but we are not satisfied yet that, even as a "bye-"product," except within certain limits, and under certain circumstances, electricity supply would form for a gas-works a good commercial speculation. Ascot and one or two other places are proposing to remove all doubt upon the subject. We shall see.

However, just before Herr Kobbert was stating his views at Mannheim, Mr. Alexander M. Cobban was claiming, at the Windsor meeting of the Association of Water Engineers, that the electricity he employs for power at the pumping-station from which Scunthorpe is supplied with water, some $4\frac{3}{4}$ miles away in the wilds, is actually a bye-product of the gas-works. The fuel used under the steam-boilers at the works is coke breeze and sweepings; and the steam is utilized both for the gas-works machinery and for the electricity generating plant. Mr. Cobban regards this as the best way of obtaining his power. Whether it is or is not, is a question we can dismiss here; the only point of interest for us being that of regarding electricity as a bye-product of gas manufacture. If Mr. Cobban had a steam plant at the pumping-station, it would involve the expense of carting solid fuel every day over $4\frac{3}{4}$ miles to a somewhat inaccessible place, instead of, as now, simply transmitting gas-works generated electricity by cable. Therefore, by coal being carbonized and gas produced, the resultant coke breeze being used under the steam-boiler, and the steam being employed for the generating of electricity, Mr. Cobban saves cartage, and the pumping-station is innocent of steam plant and its costly accessories. He is satisfied that in this case the right thing has been done; and that the electricity used for the pumping-station may be truly regarded as a bye-product of the gas-works. With Mr. Cobban, there can be no cause of dispute from a gas engineer's point of view. He is contented, and that is the main thing. Gas-works are ever willing to do all sorts of business within the limits of their powers—at a profit.

Professor Smithells on the Phenomenon of Flame.

Those of our readers who have followed the career of Professor Smithells doubtless shared the gratification we felt at the announcement that he was to preside over the work of the Chemical Section at the annual meeting of the British Association this year at Leicester. The meeting opened last Wednesday; and the next day Professor Smithells delivered his Inaugural Address. It was naturally expected (indeed, it was intimated in a forecast of the proceedings) that he would deal largely with a subject to which he has devoted special attention—viz., the phenomenon of flame; and it will be seen from the extracts given in another column that he brought under the notice of his audience matters of considerable interest. He

pointed out that the consideration of flame temperatures has become of increasing importance in the arts, owing to the use of the Welsbach mantle. He showed that the great improvements made in atmospheric burners depend primarily upon the fact that the smaller the external surface of a flame from gas consumed at a fixed rate, the higher must be the average temperature; and since the emission of light from a mantle is proportional to a high power of the absolute temperature, a small increase in temperature has a great effect on luminosity. The portion of the address we have given is of special value to our readers; and we therefore commend it to their attention. They are already acquainted with the author's investigations in the direction indicated; and they will doubtless look forward to the results of those which we are told are being carried out by Professor Bone at the Leeds University, especially as, in his capacity of head of the Fuel and Gas Engineering Department, he has lately come into such close touch with the industry with which they are identified. Professor Smithells concluded his address with some general observations on the progress of chemical science.

The Sliding-Scale and Profit-Sharing in Boston (Mass.).

Readers may possibly remember that about two years ago there was an amalgamation of the Gas Companies in Boston (Mass.), and that the new organization started on a fresh career under the presidency of Mr. James L. Richards, who had worked out the consolidation scheme, and carried it into effect. Mr. Richards, who is a man of remarkable business capacity, soon made it known that he intended to take the direct management of the concern, and "run" it (to use an Americanism) on thoroughly up-to-date lines; and early intimation was given that the consumers would have a great deal more attention than they had hitherto received. A conspicuous item in his "progressive" programme—in the right sense of the term—was the reduction of the price of gas; and the first step in this direction was taken on July 1, 1905, when the charge of $1 per 1000 cubic feet was lowered to 95 c. It will be seen, from an article which appears elsewhere, that three similar reductions have since been made—the last coming into operation on the 1st ult. As the Company are working under the sliding-scale system, they may increase their dividend for the year commencing July 1, 1908, to 9 per cent.—that for the year closing on the 30th of June last having been 7 per cent. For the current twelve months it will be 8 per cent. Not only have the consumers and shareholders profited by the Company's advanced policy, but the employees also; for a profit-sharing system similar to the one initiated by Sir George Livesey (some of the beneficial results of which are noticed elsewhere), is in operation. Consequently, the three parties immediately concerned with the Company's operations—the consumers, the shareholders, and the employees—share in the prosperity of the undertaking. But the advantages of the sliding-scale are not confined to the financial benefits resulting from its adoption. It has undoubtedly been the means of securing the good-will of the citizens. Proof of this is afforded by the remarks of Mr. Louis D. Brandeis which will be found in another column. This gentleman is a prominent lawyer, a leading citizen of Boston, and a member of the Public Franchise League—a body which has had much to do with guarding the interests of the public in connection with gas legislation. When his observations are read in the light of the fact that till comparatively recently he was an opponent of the old Gas Companies, the wisdom of the adoption of the policy which has effected the change in his attitude will not require emphasizing. Mr. Brandeis acknowledges that Mr. Richards has shown that a man may become recognized as a useful public servant while he is engaged in the business of making money for his stockholders; and that "the surest way to make money in public franchise corporations is to co-operate with, instead of antagonizing, the people." He considers that if more of the corporations referred to were managed by men of the ability, enterprise, and public spirit of the President of the Boston Consolidated Gas Company, "the cry for municipal ownership would soon subside." This is testimony which, coming as it does from a man of the position of Mr. Brandeis, we are pleased to place on record.

In another part of the "JOURNAL" will be found the programme for the annual meeting of the Irish Association of Gas Managers, which will be held in the Lecture Theatre of the Royal Dublin Society, next Tuesday, Mr. T. J. Reid presiding.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 404.)

THE Stock Exchange has had a really disheartening week; for, bad as things were before, they went from bad to worse. Consols again were about the weakest spot in the markets; and the persistent selling at last caused a measure of apprehension. To be sure, the low prices tempted a few buyers for investment to step in; but there were no operations of any magnitude sufficient to stem the rout. As to the responsible factors specially affecting last week—apart from those adverted to in our last issue—there was the Moroccan incident, which did not fail to arouse anxiety, occurring as it did in a quarter which is dreaded almost as an international powder magazine. Then the affair of the Irish Police did not tend to infuse a brighter tone; and the railway agitation was again prominently in view. From the opening on Monday, things commenced to fall. Consols were half-a-point lower, on forced sales; and the general outlook was dark. On Tuesday, a deeper depth was reached; and Consols marked $82\frac{3}{8}$, which must be quite a record. But before the day closed there was something of a rebound from the lowest point. Thus Wednesday opened rather less dismally. The improvement, however, did not last; and the announcement of a failure appeared ominous. From this point the depression increased, with scarcely a ray anywhere; and so the week came sadly to an end on Friday—Saturday being a closed day. In the Money Market there was a good demand, which materially hardened rates for short loans; and discount stiffened somewhat also. Business in the Gas Market was very quiet, and changes were few and slight. In Gaslight and Coke issues, the ordinary was lightly dealt in at prices ranging from 96 to $94\frac{1}{4}$ (a fall of 1). In the secured issues, the preference marked $105\frac{1}{4}$; and the debenture, 82. South Metropolitan was quiet and firm, and was done at from $120\frac{1}{2}$ to 122. The debenture marked $82\frac{1}{2}$. One bargain in the 4 per cent. at $106\frac{1}{2}$ was all the business in Commercials. In the Suburban and Provincial group, Alliance old marked $20\frac{3}{4}$; British, $41\frac{1}{2}$; and West Ham, $104\frac{1}{2}$. Among the Continental Companies, Imperial changed hands at from 175 to $173\frac{1}{2}$, and Cagliari at $26\frac{1}{2}$ and $26\frac{1}{4}$. Among the undertakings of the remoter world, Buenos Ayres was done at $11\frac{1}{8}$; Cape Town preference, at 8 special; Oriental, at $141\frac{1}{2}$; Primitiva preference, at $5\frac{1}{4}$; and San Paulo, at $13\frac{1}{4}$.

ELECTRIC LIGHTING MEMORANDA.

Incongruous Voltages and Lamps and other Appliances—Reforming the Nernst Lamp—Photometry to the Rescue of the Incandescent Electric Lamp User—Osram Lamps and Side Street Lighting.

A PARTICULARLY outspoken article by Mr. A. C. Hanson has appeared in the "Electrical Review." Its purport is the case for low-pressure electricity distribution; it also shows in parallel the fearful muddle the electrical industry is in between voltages and new lamps and appliances. The primary reason for going from low to high—that is to say, to about double the old—pressures was the saving of copper; and when the price of copper to-day is looked at, the bare thought of retracing steps to low pressures, with the double disadvantage for the electricity concern of greater capital outlay and reduced consumption through the economy of the metallic filament lamps at low voltages, is enough to make the station engineer perceptibly shiver. Well, Mr. Hanson has some unkind—they may be justifiable—things to say about high voltage carbon filament lamps. He asserts—and who can dispute the assertion?—that they are worse now than the low-voltage lamps of year ago. Later, in a couple of passages, he makes a point that has frequently been put forward in these "Memoranda." "With," he says, "a statutory declared voltage of 250, in reality ranging from 240 to 270, the light given by a 250-volt lamp is a very variable quantity, and is not often that at which it is rated. The price per Board of Trade unit by itself is only a very rough indication of the cost of electric light." Mr. Hanson rubs in the case thickly for low voltages; but to what purpose under the conditions of electricity supply in this country, is a question over which we shall not trouble to rack our brains. He tells station engineers something of which they are all too painfully aware—that practically all the different types of lamps are better on low than on high voltages for which distribution systems are laid out. The carbon filament lamp is more efficient on low voltages, the metallic filament lamp may be used singly on them, the open type arc lamp may be burned economically in pairs, and the enclosed arc lamp singly. The only commercial lamp that is really better on high than low voltages is the Nernst; but—this is a case of hitting a lamp when it is down—"few consumers would be sorry if this type of lamp was as dead as Queen Anne, if they could use metallic filament lamps without being under the necessity of running them in series." With this, the hard-hitting Mr. Hanson has not done with the Nernst lamp, but gives it a second blow in the sentences: "The initial efficiency of the Nernst lamp, though probably never as high as is claimed by the makers, is certainly better than that of the carbon filament lamp, but its very rapid deterioration and general unreliability make it but a doubtful blessing to users of electric light."

Mr. Hanson finds it difficult to believe that a satisfactory low

candle-power lamp at 220 volts will be produced; and at present practically all the metallic filament lamps have to be run in series on high voltages—this being inconvenient in some instances, and quite unsuitable in many. In the case of arc lamps, the advantage of low pressures is admittedly not so great; and, in this connection, we have the writer of the article admitting that where quantity of light is the only requirement, the flame arc lamp is probably the only form of electric lamp—at the average rates of charge—which will show a decided economy over the latest forms of high-pressure gas-lamps. For shop lighting, we quite agree—apart from capital expenditure, lamp renewals, expensive carbons, and attention—if the alternative is between two high-pressure gas-lamps and four flame-arc lamps, in many cases the gas-lamps will win. Breaking from Mr. Hanson for the moment, while referring to flame-arc lamps, it may be mentioned that in the "Electrical Times" an article has appeared on the magnetite arc lamp, in which, allusion having been made to one difficulty, it is remarked "the other difficulty with the lamp (*in common with flame arcs*) still remains. It is that the magnetite electrode is volatilized, and leaves a reddish soot that settles on everything it touches, so that a chimney is a very necessary feature in the lamp." Returning to Mr. Hanson, he admits that for large motors the advantages of high pressures may be allowed; but the great majority of motors are of a size more suited to low voltages. He also attributes the slowness of the advance in the electrical heating department to "at least in part," the prevalent high voltages. Running expense and low efficiency, unreliability, and cost of repairs, we happen to know, are other causes. There is much in the article that, in the interests of the electrical industry, must not be permitted to reach the eyes of the general public; but there are two among the final points in the case for low pressures that we would strongly counsel should be kept strictly hidden from the outside world. Says Mr. Hanson, "a 220-volt shock is decidedly disconcerting to nearly all, and absolutely dangerous to some; whereas a 110-volt shock would hardly be felt by the majority. Of course, no one should be exposed to the risk of shocks; but in these days of jerry wiring and jerry building, the marvel is that so many escape." On the question of meters, it is said that "even with careful supervision, it is impossible to ensure that a large proportion of meters will even start on a 220-volt 8-candle power lamp"—that is to say, many electricity consumers may find, by a very simple test, that they can run an 8-candle power lamp week in week out without the meter making any note of the fact. But there we are. The sum and substance of Mr. Hanson's article is that high voltages have been largely perpetuated in this country, and there is hardly anything among the new lamps and appliances to fit them.

Allusion is made to the Nernst lamp in the opening paragraph, from which it will be gathered that the complaints of many months ago as to this type of lamp have been fully justified. The makers themselves now also admit that there was ground for those complaints. They were pushed into such a corner over them, that they were bound to do something to preserve the Nernst lamp business from utter extinction. Statistics were collected by them, relating to the premature failure of the "burners;" and the result of the inquiry has shown the necessity for improving the heater circuit, which generally failed, and in some cases caused breakage of the filament. Unfortunately, the makers are unable to dispense with the heater circuit, but (they give their word for it) that this circuit is now perfectly controlled by improving the insulation and design of the cut-out coils. Things must indeed have been bad, seeing they are fitting free the new cut-out coils to all Nernst lamps of which they have any record; and since April 1 they have refitted no less than 22,700 lamps in different parts of the country. Of the old coils returned, about 60 per cent. were entirely burnt out. Well we shall see now whether this simple change has really eradicated a long-continued disease. If it proves to be so, why was it not made before?

Such a large number of electricity lamps on the market are so inefficient and wrongly graded that, in the protection of the consumers, some central station engineers are taking up the much neglected (among them) science of photometry. But those engineers are of the few and not of the majority. The few have been forced to the conclusion that their responsibilities do not end with the provision of electricity, but that they must keep watch and ward over mischievous influences at the consumers' end. Mr. R. M'Court read a paper on this subject, at the recent meeting of the Incorporated Municipal Electrical Association, telling what is being done at Harrogate, in this matter of testing lamps, by the Electricity Department in co-operation with the local contractors; and the testing, with the rejection of the inefficient lamps, is very essential. It is noticed, however, that lamps are certified as fit for use which come within very wide limits. For instance, 5-candle power lamps are satisfactory which come anywhere between the limits of 4 to 6·5 candles; 8-candle power lamps, between 7 to 9 candles; 16-candle power lamps, 14 to 18 candles; 25-candle power lamps, 22 to 28 candles; 32-candle power lamps, 28 to 36 candles. A 12½ per cent. difference either way is a pretty big margin; but its adoption is in agreement with the specification of the Engineering Standards Committee. This is pretty conclusive evidence that the manufacture of electric lamps falls very short in exact result. One speaker in the discussion on Mr. M'Court's paper suggested that lamps should be started on their career in more perfect condition than with such a great variation as 12½ per cent. either way from their reputed candle power. We quite agree with him; for incandescent electric lamps are not long in departing on their own account, and by the aid of inconstant voltages, from their original performance. Another speaker cited the case of one consumer who was using a 32-candle power lamp giving only 18 candles, and another with a 16-candle lamp giving only 6-candle power. How can electricians hope to be exempt from the complaint of consumers under such conditions? At Blackpool they are satisfied if so-called 16-candle power lamps come within 5½ watts per candle and do not fall below 10 candles!

Then there are the much-vaunted Osram lamps. We recently showed that their nominal illuminating power is given in Hefner units, instead of British standard candles, and that they, like the carbon filament lamps, do not in use establish claims. We have Mr. M'Court's testimony on this head. He states that, with the last six dozen Osram lamps tested at Harrogate, the actual illuminating power of the 32-candle lamps varied from 17 to 36 candles; and the watts used from 29 to 36. The 50-candle power lamps varied from 27 to 44 candles; and the watts from 36 to 48. This does not by a long chalk meet the Standards Committee's specification for carbon filament lamps. Other speakers referred to the difficulty of pairing these lamps; and proper pairing is very essential for good effect and result on most electricity distribution systems. The "Electrician" is looking to these lamps—some day—solving the problem of the lighting of side streets; and our contemporary is partly persuaded on this point by a statement of Mr. M'Court that he had photometrically compared one Osram lamp and one incandescent gas-lamp in the streets. During one month they were giving respectively 54 and 36 candles; and the previous month 54·5 candles and 25·2 candles respectively. This was street photometry, and by the Harrison photometer! Sufficient said. But Mr. M'Court is asking much if he expects us to place reliance on such figures. We should like to point out to him that it seems rather strange that, in the street, he should have got a return of 54·5 and 54 candles from a 50-candle Osram lamp, while from the 50-candle part of the parcel of six dozen Osrams, tested under the more refined conditions of the laboratory, he found the illuminating power varied between 27 and 44 candles. The figures of 54·5 and 54 do not therefore evoke much confidence; but nevertheless the "Electrician" uses them as the text for a whole editorial article. There is no reason why a 3 cubic feet incandescent gas-lamp should, unless there is neglect, be actually giving anything like so low a return as 25·2 candles. But the figures for these two isolated lamps are used to show that, with electricity at 3d. per unit and gas at 2s. 10d. per 1000 cubic feet, there is a saving—by electrical calculation on paper—in favour of electricity of 17·6 per cent. Now an incandescent burner, consuming 3 cubic feet an hour, should give a light of about 50 candles (not between 17 and 44 as Mr. M'Court says is the case with the 50-candle power Osram lamp); and three pennyworth of gas at 2s. 10d. per 1000 cubic feet should last about thirty hours. An Osram lamp, using 52 watts per hour, would run away with a threepenny unit of electricity in less than ten hours. Say, too, that for street lighting these Osram lamps would have to be renewed at least four times a year, reckoning the long life attributed to them under the benevolent regulated conditions of the laboratory, there would be another 17s. a year to be expended. However, although the "Electrician" thinks that "such a lamp *really appears* to afford a solution of the problem of side-street lighting," it adds these ominous words:

> In the case of street lighting, there is something to be said in favour of using a number of low-voltage lamps in series. The difficulty in doing so, however, apart from the question of extinction of a number of lamps through the failure of one, is that all lamps required for running in series on any one circuit must be made practically identical in order to give satisfactory results. At the present stage of manufacture, it is quite possible that this difficulty cannot be very satisfactorily met without careful selection. A certain amount of trouble has been caused on private lighting circuits by lamps differing to some extent, so that both lamps of a pair do not burn at the same efficiency; but this difficulty is, no doubt, one that will gradually disappear.

Trust our electrical friends for pointing out a good feature of their wares without finding some counterbalancing disadvantage. We will not complain. Honesty is the best policy. But where these lamps are strung up in series for street lighting, there we can see more troubles in store for the public from failures of the light. There the subject may be left for the present.

Mr. T. D. Hall, late Manager of the Montrose Gas Company (and latterly residing in Edinburgh), died suddenly at his residence there, No. 59, Viewforth Gardens, on Thursday last. His remains were interred at St. Andrews on Saturday.

MM. L. Fabre and P. Espinasse have devised the following process for the manufacture of an impermeable compressed block withstanding great pressure, and constituted by a mixture of gravel and sand cemented together with coal tar. The materials are mixed and heated to a very high temperature, and then compressed hot and cold, either by a roller or by hydraulic stones, and finally dried. This compressed material can, it is stated, be employed like cement, concrete, asphalt, &c., as it can be cast in the form of flags or paving-blocks for roads, pavements, foundations of buildings in damp soil, or drain and water pipes. Its crushing strength is considerable, and it makes a very good road surface for traffic, as there is no dust, and it can be washed without production of mud.

INTERNATIONAL PHOTOMETRIC COMMITTEE.

Second Session at Zurich.

From our Special Correspondent.

(*Continued from p.* 301.)

The communications by Heer van Rossum du Chattel and Mr. J. W. Helps, as to the methods generally followed in Holland and England respectively for measuring the light of incandescent gas-burners, which have already been given in the "Journal" (*ante*, pp. 224 and 235), were presented in pursuance of a scheme propounded at the 1903 session of the Committee for the collection of such information from all the countries represented. But from no other countries except Germany was information forthcoming; and this was for the most part a recapitulation by Dr. Krüss, of Hamburg, of particulars already published in the annual reports of the Photometric Committee of the German Association of Gas and Water Engineers.* He referred to the fact that the Association had formerly issued rules for the testing of incandescent burners, and that they had come up for revision. But the advent of the inverted gas-burner had rendered it necessary to make them considerably more comprehensive; and the required modifications were now being considered by the Committee of the Association. The question of the best means of determining the lower hemispherical illuminating power of sources of light had to be settled by the Committee. Professor Drehschmidt followed with some observations on the use of the Ulbricht sphere and mirror photometers for the determination of mean spherical illuminating power.

Discussion ensued as to what apparatus should be employed for testing the illuminating power of mantles, and whether their standard illuminating power should be taken to be (1) the horizontal intensity, (2) the intensity in whatever direction it is at a maximum, (3) the mean spherical intensity, or (4) the mean hemispherical intensity. Professor Brodhun reported that the Imperial Physico-Technical Institute at Charlottenburg had not investigated any apparatus for determining the mean hemispherical illuminating power. It would be of a special type. For spherical photometry, the globe of Professor Ulbricht, of Dresden, or mirrors were used; but the Institute had so far done little in spherical photometry. Mr. Paterson, in answer to a question, said that the National Physical Laboratory had as yet no special apparatus for the determination of spherical illuminating power, but they had used M. Laporte's method with two rotating mirrors, which admitted of a distribution curve being obtained. M. Lauriol stated that he had two of Blondel's spheres, one 80 centimetres and the other 3 metres in size; but he had made only a few tests with them, and had no information as to their exactness. For testing the efficiency of street-lamps, he had made measurements with mirrors of the lower hemispherical illuminating power, which was the most important for this purpose. But for the lighting of interiors, the spherical illuminating power became more important because of the reflection of light from the ceilings and walls. He would be disposed, when comparing upturned with inverted burners for lighting rooms, to take the spherical illuminating power of the former and the lower hemispherical power of the latter. In reply to a question as to whether the light of incandescent gas-burners—especially powerful ones—would not be affected by their being enclosed in a sphere for photometrical purposes, he agreed that it was quite possible it would be so. He also said that the large sphere which he had had made was dead-white inside, and was perhaps more like Professor Ulbricht's pattern than the original Blondel illumination photometer.

Dr. Krüss later presented a report on the negotiations which had taken place between the Association of German Electricians, the Association of German Electricity Works, and the German Association of Gas and Water Engineers, with a view to the adoption of general rules for the photometry of both electric arc and incandescent gas lamps. The electricians had proposed the following prescription: "The efficiency of an arc lamp is estimated practically according to its most important application—viz., for the direct lighting of the space beneath the horizontal plane of the source of light. Therefore the mean lower hemispherical illuminating power constitutes its practical measure. For this mean lower hemispherical illuminating power, the symbol I_U is proposed, and HK_U for its value expressed in Hefners. To this may be added, in brackets, the factor (k), by which the mean lower hemispherical illuminating power must be multiplied in order to give the mean spherical illuminating power, using the expression ($k_o = \ldots$)."

Gas engineers had pointed out that the gas industry differed from the electrical industry in that it had a great number of sources of intensity, ranging from the ordinary Welsbach burner to the powerful intensified burners, with which the light emanating upwards was not always small as with the electric arc light, which was practically the only high-power light the electricians had to consider. Consequently, gas engineers attached great importance to mean spherical illuminating power. But they granted that for outdoor lighting only the lower hemispherical illuminating power came into account; and to this extent they agreed that the proposition of the electricians might be applied in substance to high-power gas-lights. The German Association of Gas and Water Engineers would undertake to consider in what way the rules for the photometry of arc lamps could be made applicable to high-power gas-lights for outdoor lighting. It might be possible to state also the mean spherical illuminating power directly, and not only through the medium of the factor k_o, though the use of the factor was valuable in that the ratio of the light radiated above a horizontal plane to that radiated below it could by its aid be readily calculated.

Further discussion ensued upon Dr. Krüss's communication, and some of the points discussed were raised again the following day, when Professor Drehschmidt's proposed symbols for representing the manner in which illuminating power had been determined (see *ante*, p. 224) were agreed to.

Before the re-assembling of the Committee on the afternoon of Friday, the 19th ult., most of the members accepted an invitation from Professor E. J. Constam to visit the recently established Fuel-Testing Laboratory attached to the Polytechnic. The visit was most instructive. Owing to the dearness of coal and of briquettes in Switzerland, consequent on the whole supply of fuel having to be imported from a considerable distance, the State decided to establish this testing laboratory, under Professor Constam's charge, for the purpose of checking the quality of the fuel bought by the State railways and private users. The freight on coal carried to Switzerland is a considerably heavier item than the original cost of the coal, and is, of course, the same whether the coal is of high or low quality. Consequently, it does not pay the Swiss to import inferior coal; and it answers to inspect and test the supplies very thoroughly in order to exclude coal which is indifferent or not up to the specified quality.

The new testing laboratory serves to control the quality of the supplies, and also incidentally to determine the most suitable coal for different uses. It comprises a well-arranged and well-equipped building, on the ground floor of which are rooms for unpacking the samples, air-drying, and crushing them. The friability of briquettes is tested by means of a rumbling drum, into which 50 kilos. (about 1 cwt.) of the briquettes are put. The drum is given a certain number of turns at a definite speed, and is then opened, and the contents are turned out on to a screen which is agitated so that the dust falls through on to a tray in which it is weighed. All samples of briquettes are treated in precisely the same manner, so that the results are strictly comparable. Those which under this treatment produce more than 50 per cent. of their weight of dust, are considered too friable, and would be rejected for the State railways, which mainly use this class of fuel. The drum and indeed all the mechanical appliances used in the laboratory are driven by electric power. Various crushing-machines, for reducing the samples to different degrees of fineness, are provided, and there is an ingenious press for compressing a small measure of finely divided coal into a tablet, which is then weighed and introduced into a bomb calorimeter for the determination of the calorific power.

The calorimeter room upstairs contains six platinum-lined bomb calorimeters of good design, in which the weighed portion of fuel is burnt by oxygen admitted from a cylinder under pressure. The nitric acid formed from the nitrogen always present in small quantity in the compressed oxygen is estimated volumetrically, and the sulphuric acid from the sulphur in the fuel is also determined. The ash is determined in muffle furnaces, and the coke in platinum crucibles heated for a specific time over a screened and governed gas-flame. The gas supply to the various rooms is taken through a 2-inch pipe, so that the turning on or off of one or two burners has no effect on the rate of consumption of the others. There is a furnace-room for ultimate analyses, a well-equipped balance-room in which female labour gives satisfaction, and a strong-room in which a quantity of special platinum apparatus is stored. The samples of ash and coke kept for reference are not the least useful part of the contents of the laboratory. There is a room with a Junkers calorimeter for testing gas; also a small library of modern works on fuel. Altogether, the arrangements reflect the greatest credit on Professor Constam, who is responsible for them, and who continues to act as Director of the Laboratory.

After the members of the Committee had returned from their visit of inspection, M. Vautier, the President, referred to the platinum unit of light proposed by M. Violle more than twenty years ago, and to our more recent knowledge as to the melting-point of pure platinum. The work of Moissan with the electric furnace, and the production thereby of chemically pure platinum, had, he said, greatly simplified researches with this metal. Quite recently Mr. Harker had, with a special type of electric furnace, still further simplified the manipulation; so that now determinations could be satisfactorily undertaken on the melting-point of platinum. These would be of the greatest importance in the practical application of molten platinum as a unit of light.

Mr. Helps said M. Vautier had earlier communicated with him with reference to Mr. Harker's paper before the Royal Society (in which he described his electric furnace), and had suggested that with this furnace platinum might possibly be kept at the fusing-point, and so made applicable as a primary standard. He had thereupon made inquiries, and had ascertained that, if the International Photometric Committee had expressed any wish that Mr. Harker should apply his electric furnace towards the establishment of a molten platinum primary standard, the research would be carried out at the National Physical Laboratory. Mr. Paterson said Mr. Harker's furnace seemed to promise a means of obtaining a constant high temperature. Probably with it the method to be followed would be to raise the platinum to about 1800° C., allow

* See "Journal," Vol. XCVIII., p. 812.

it to cool down nearly to the point of solidification, and then retard the cooling in order to obtain at this point the desired standard of light. The furnace tube of Mr. Harker's largest furnace hitherto was only 15 millimetres in diameter; but for the work on the molten platinum standard, if undertaken, a furnace with a tube 25 or perhaps even 30 millimetres in diameter would, if possible, be employed. Some discussion took place as to the material of the Harker furnace; and Dr. Brodhun mentioned the Nernst electric furnace in use at the Reichsanstalt, in which a lining of iridium is employed.

M. Vautier next spoke on the unification of the different methods for determining the illuminating power of incandescent gas lights. He said it was most important to distinguish between the several elements, as, for instance, the burner, the mantle, the form and temperature of the flame, and the position of the mantle in the flame. It was desirable to have a recognized standard burner for mantle testing, and to have the mantles of determined size and form. After M. Sainte-Claire Deville, Herr Strache, Professor Drehschmidt, and others, had spoken, the President suggested that a consumption of 100 litres (3·53 cubic feet) per hour under a pressure of 40 millimetres (16-10ths) should be recognized as standard conditions for incandescent burner and mantle testing. But Professor Drehschmidt pointed out that the normal rate of consumption in Berlin was 120 litres (4·24 cubic feet) per hour, and said it would not answer to use a lower rate for testing purposes. It appeared to be still too soon to fix a standard burner and standard conditions for mantle testing.

The Committee sat, on the morning of Saturday, July 20, under the chairmanship of Herr Nolte, of Berlin, as the President was assisting at the deliberations of the Sub-Committee who were engaged in settling the ratios to be adopted between the intensities of the three chief standards of light. The first matter dealt with was the unification of screw-threads. It will be remembered that the consideration of this subject was somewhat anomalously referred by the International Gas Congress of 1900 to the International Photometric Committee who were then established. M. Payet presented a paper on the question at the first session of the Committee in 1903; and a Sub-Committee were then appointed to communicate with the Technical Associations of the different countries with regard to it.* Dr. Hugo Krüss now reported what had taken place in the meantime in Germany with reference to it. He said that the proposals of M. Payet, which he himself favoured, had come too late to the knowledge of those concerned in Germany for them to find general acceptance. The German Technical Associations had agreed to conclusions which he had reported at the fifteenth assembly of German Mechanical Engineers at Goslar, in 1904. The Association of German Engineers had, after consultation with the Associations of Gas and Water Engineers, of Heating Engineers, and of Pipe-Makers, decided, in 1903, to adopt the Whitworth threads for all pipes with threads from 13 mm. to 114 mm. (½ inch to 4½ inches) in diameter. The Associations of Opticians and Apparatus Makers, however, decided to adopt for optical and delicate mechanical work the international system of screw-threads. Full details of the data which led up to, and are involved in, these decisions will be found in Dr. Krüss's report in the "Zeitschrift für Instrumentenkunde," 1905, pp. 22-23.

M. Sainte-Claire Deville next recited the chief points of his long report on the researches which he has carried out since the first session of the International Committee on the illuminating power, both in ordinary and incandescent burners, of coal gas, water gas, and mixtures of the two. He referred to the various influences to which the illuminating power of gas, as expressed by the number of litres (*i.e.*, the rate of consumption) required to yield the unit of light, is subject. For instance, it was affected by the quantity of air reaching the flame, and the degree of completeness of combustion. He believed that the calorific power of the gas had a considerably greater effect on illuminating power than the temperature of combustion, and he thought a determination of the calorific power should serve as an exact criterion of the value of the gas. He proposed, therefore, that testing the illuminating power of the gas should be given up in favour of determination of calorific value. An abstract translation of M. Sainte-Claire Deville's voluminous communication will be published in the "JOURNAL" shortly; so that it is unnecessary now to go more fully into its contents. Professor H. Strache offered a very vigorous criticism of the author's contentions. He referred to the effect on illuminating power of the size and shape of the flame, and of the temperature of combustion. These points were not yet, he said, sufficiently considered. It was essential that further investigations should be carried out before the old modes of testing were given up as the author had proposed.

In the afternoon, as already reported, Mr. Helps read the paper by Mr. Carpenter and himself on the "New Standard Test Burner for London Gas" (*ante*, p. 235); and then the resolutions of the Committee were passed and the proceedings brought to a conclusion, as stated in the first instalment of this report (*ante*, p. 224). A point of interest in regard to the Metropolitan argand burner No. 2 was that Dr. L. J. Terneden, of Amsterdam, had with him a specimen of an argand burner, devised by Heer E. F. v. d. Waereld, of Utrecht, in 1902, in which the internal air supply only can be regulated by a damper rotating on a screw, as does the damper of the "Metropolitan" argand. This burner was adopted in 1903 by the Dutch Association of Gas Managers.

* See "JOURNAL," Vol. LXXXIII., p. 34.

PROFESSOR SMITHELLS ON THE PHENOMENON OF FLAME.

THE Annual Meeting of the British Association was opened at Leicester last Wednesday, under the presidency of Sir David Gill, late Astronomer-Royal at the Cape; and the following day the work of the various sections commenced. The President of the Chemical Section is Professor A. SMITHELLS, B.Sc., F.R.S., who chose as the subject of his address "The Phenomenon of Flame." The following are the portions of the address which bear upon this interesting question.

The topic of flame, after a long period of repose, has aroused much interest during late years; and I think we may say that some considerable progress has been made in its elucidation, though in this, as in all other subjects of scientific inquiry, the more closely we scrutinize it the more impressed must we be with what still remains unknown.

One of the first questions to meet us in the study of flame is that of the temperature at which, in any given case, the phenomenon becomes evident. Here, I think, a great clarification of view has taken place. The old idea that there existed a fixed temperature at which inflammation suddenly took place cannot now be maintained, and the term "ignition temperature" has acquired a different meaning. It is now known that in a very great number of cases a mixture of two flame-forming gases, when gradually raised in temperature, will develop luminosity quite gradually *pari passu* with the chemical combination that is being induced. This phenomenon is, of course, known universally in connection with phosphorus; but it is not so widely known in connection with other combustible substances. I do not know how many times the independent discovery has been made that sulphur, arsenic, carbon disulphide, alcohol, ether, paraffin, and a whole host of other compounds, inorganic and organic, will phosphoresce as truly as phosphorus itself—that, in fact, phosphorescent combustion is the normal phenomenon antecedent to what we ordinarily call flame.

This is, after all, only in harmony with the general truth that chemical combination between two gases does not set in suddenly, but comes into evidence quite gradually as the temperature is raised from a point at which the action, if it occurs at all, is so slow as to be negligible. The change from phosphorescence to ordinary flame is not sudden, but the appearance of ordinary flame is the end-point of a continuous, though rapid, development. This end-point is the temperature of ignition. What, then, determines the temperature of ignition? The answer to this question has been given with characteristic conciseness by Van 't Hoff as "the temperature at which the initial loss of heat due to conduction, &c., is equal to the heat evolved in the same time by the chemical reaction."

Temperature of ignition is, then, neither a temperature at which combination suddenly begins, nor one dependent solely on the nature of the combining gases. It will vary with the proportion in which the gases are mixed and with their pressure and other circumstances. Notwithstanding the simplicity of this conception, it must be admitted that there are many obscure facts connected with the ignition of gases. The inflammability of gaseous mixtures is not necessarily greatest when they are mixed in the proportions theoretically required for complete combination. The influence of foreign gases does not appear to follow any simple law; the presence of a very small quantity of a foreign gas may exercise a profound influence on the ignition temperature as in the case of the addition of ethylene to hydrogen. When a mixture of methane and air is raised to its ignition temperature, a sensible interval (about 10 seconds) elapses before inflammation occurs. These facts are cognate to others which have increased upon us so abundantly in connection with the influence of moisture on chemical change.

The structure of flames has always been regarded as dependent upon the chemical changes taking place in the differentiated regions; but until recent times little attention has been given to any question beyond the cause of the bright luminosity of hydrocarbon flames. In a flame such as that of hydrogen or carbon monoxide, where we have some reason to suppose that the same kind of chemical transaction is taking place throughout the region of combustion, we should not expect to find a differentiation of structure; and, as a matter of fact, we do not find any. Erroneous ideas have gained currency from the use of impure gases; and hydrogen is still described as burning with a pale blue flame, although Stas long ago stated that if the gas is highly purified, and the air freed from dust, the flame, even in a dark room, can only be discovered by feeling for it—a fact consistent with the line spectrum of water lying wholly in the ultra-violet. The presence of a very small quantity of free oxygen in carbon monoxide destroys the perfect simplicity of the single shell of blue flame with which the purified gas burns; and in other flames small quantities of gaseous impurities or of atmospheric dust give rise to features of structure and halos which have been frequently supposed to pertain to the flame of the combining gases. The fringe of a flame in air may be often tinged by the presence of oxides of nitrogen.

No flame better illustrates the relation of structure to chemical processes than that of cyanogen, where the two steps in the oxidation of the carbon are clearly marked out in colour. Apart

from hydrocarbon flames, very few others have been carefully explored from this point of view. There is, unfortunately, no gas composed of two combustible gaseous elements; and, though such gases as the hydrides of phosphorus and sulphur do not fall far short of this, the experimental difficulties of an exact exploration of their flames are very great. We are thus prevented from studying the flame of a composite combustible in its simplest of forms.

The flames of hydrocarbons have naturally been the subject of most frequent investigation. The use of single hydrocarbons instead of the mixtures present in coal gas and other common combustibles has simplified the study considerably. Two problems stand out prominently. One is to trace the steps in the oxidation of the hydrocarbon; the other to account for the bright patch of yellow luminosity. With regard to the question of the luminosity, I do not think there is any longer doubt about its being due essentially to the separation within the flame of minute solid particles of what is practically carbon. The separation seems to be adequately explained by the high temperature of the blue burning walls of the flame, which decomposes the unburnt hydrocarbon within. In a similar way, arsenic and sulphur and phosphorus are liberated within flames of their hydrides; but these elements, being volatile, do not appear as solids unless a cold object be placed within the flame. In the case of the hydride of silicon, the liberated element at once oxidizes to form the solid non-volatile oxide, which gives a bright glow.

The mode in which a hydrocarbon yields carbon by the application of a high temperature has been the subject of experiment and of hypothesis. But neither the view of Berthelot, that the carbon results from a continual coalescence of hydrocarbon molecules with elimination of hydrogen, nor that of Lewes, according to which the formation and sudden decomposition of acetylene is the essence of the phenomenon, appears to me to be in harmony with the experimental facts; and I am not aware that either view has secured any support from other workers in this field. It is certainly not easy to ascertain experimentally the changes undergone by a single hydrocarbon as its temperature is raised; and at the last it may be objected that the course of events in contact with the solid walls of a containing vessel is not necessarily the same as that within the gaseous envelope of a flame. I am glad to think that there is promise of further light on this subject from the work of Professor Bone.

The course of oxidation of hydrocarbons has been the subject of very careful and fruitful study. The old view that a selective or preferential oxidation of the hydrogen always took place—that with a restricted supply of oxygen the hydrogen was oxidized and the carbon set free—is, I think, no longer maintained by anyone who has studied the question. The explosion of ethylene with its own volume of oxygen, which leaves us with practically all the carbon oxidized and all the hydrogen free, is fatal to this view. Again, when hydrocarbons are burnt in a flame with a restricted supply of air, as is the case in the inner cone of the flame of a well-aërated bunsen burner, there is clearly no separation of solid carbon; and the products of combustion, when withdrawn and analyzed, disclose the presence of much free hydrogen and no unoxidized carbon.

The admirable researches carried out in the University of Manchester by Professor Bone and his collaborators, have afforded most valuable information as to the oxidation of hydrocarbons at temperatures extending from those of incipient oxidation up to the highest ones that prevail in a flame. According to Professor Bone, the oxidation of a hydrocarbon involves nothing in the nature of a selective or preferential oxidation of the carbon or the hydrogen; but it occurs in several well-defined stages, during which oxygen enters into, and is incorporated with, the hydrocarbon molecule, forming oxygenated intermediate produets, among which are alcohols and aldehydes. The reaction, just referred to, between ethylene and an equal volume of oxygen is, according to Professor Bone, to be represented by the scheme:

$$\begin{array}{ccccccc} CH_2 & & CH.OH & & CH.OH & & H_2C:O \quad H_2+CO \\ \cdot\cdot & \longrightarrow & \cdot\cdot & \longrightarrow & \cdot\cdot & \longrightarrow & \longrightarrow \\ CH_2 & & CH_2 & & CH.OH & & H_2C:O \quad H_2+CO \end{array}$$

There can be no question about the facts on which this scheme is based, and they are a new and important addition to knowledge; but there are reasons that prevent me from accepting entirely the interpretation which he has given to his experimental results. [Professor Smithells stated his reasons.]

The mode of burning of carbon, whether in the free state or as a constituent of a compound, is not at all easy to determine; and, notwithstanding many investigations, among which must be specially mentioned those of Professor Harold B. Dixon and his collaborators, so simple-looking a question as whether carbon forms carbon monoxide by directly uniting with oxygen, or only by reducing carbon dioxide, is still a matter of uncertainty. Our knowledge concerning the question of flame temperatures has been much improved in recent times, thanks mainly to the admirable work of M. Le Chatelier. The well-known memoir of Mallard and Le Chatelier on the explosion of gases supplied the data which first permitted of a moderately exact calculation of flame temperatures; and the perfection of the thermo-couple by M. Le Chatelier gave us the first instrument that could be used directly for making a satisfactory measurement. The uncertainty connected with this subject may be well illustrated by quoting the temperatures that had at different times been ascribed to the flame of coal gas when consumed in a bunsen burner, where we have had values from 1230° to 2350° C.

With regard to the use of thermo-couples, I may remark that the practical difficulties have been successfully met. The chief difficulty is, of course, to secure that the thermo-junction attains, as nearly as possible, the temperature of the region in which it is immersed. As ordinary flames consist of thin shells of burning gases, on either side of which there is a very rapid fall of temperature, it is necessary to use thin wires, and to dispose them so that there is no appreciable drain of heat from the junction. By using wires of different gauge for the couples, it is possible by extrapolation to arrive at a temperature for a couple of infinitely small cross section, and it is also possible to make a correction for the superior radiating power of the couple as compared with the flame-gases. Without this last correction, a maximum temperature of 1770° C. was obtained for the bunsen flame by Waggener in Germany, and 1780° by White and Traver in America. Correcting for radiation, Berkenbusch found 1830° as the maximum temperature. M. Féry, by an ingenious application of his beautiful optical pyrometer to a flame containing sodium, gives 1871° as the highest temperature of the flame of a bunsen burner burning coal gas.

The consideration of flame temperatures has become of increasing importance in the arts, owing to the use of the Welsbach mantle as a means of deriving light from coal gas. The great improvements which have been made in the efficiency of atmospheric burners depend primarily on the fact that the smaller the external surface we can give to a flame consuming gas at a fixed rate, the higher must be the average temperature; and since the emission of light from a mantle is proportional to a high power of the absolute temperature, a small increase of temperature is of great effect on luminosity. The acetylene-oxygen flame, in which a temperature of about 3500° prevails—not very different from that of the electric arc—is the hottest of the hydrocarbon flames, and finds some important practical uses.

I have already said something about the luminosity of flames so far as relates to the separation and glow of solid carbon. But there remains the more general question of the luminosity of flames containing nothing but gases. The older explanation of the emission of light from combining gases said no more than that the energy liberated during the reaction and appearing as heat raised the product to incandescence—that is to say, so increased the velocity of its molecules and the violence of their collisions that vibrations were set up whose wave-lengths lay within the limits of visible radiation. This explanation has long been questioned; and there is now, I think, a very general agreement that it will not suffice. The average temperature, in fact, prevailing in a flame, if attained in the product of combustion by the supply of heat from outside, does not suffice to make that substance luminous. We are therefore thrown back upon the conclusion that the generation of light in a flame is not a consequence, though it is an accompaniment, of the elevation of temperature.

The question now is: Can we go any farther? To do this we are led to consider individual molecular transactions instead of statistical averages; and the view presents itself that the combining atoms may, in losing their chemical energy, form directly systems of independent vibration where the radiation is such as to fall within the limits of visibility. If we picture such vibrating systems momentarily formed, it is easy to see that by their collision one with another they may acquire, in a secondary way, increased translational motion, and so lead to a state of things where the greater part of their energy is degraded in the form of heat. The high temperature of a flame would then be a consequence rather than a cause of its light. This subject of the mechanism of luminosity, however, like so many others, has now become involved with the theory of electrons, and a chemist may be excused if he hesitates to pursue the subject farther.

Professor Smithells devoted the concluding portion of his interesting address to a few general observations on the progress of chemical science, in the course of which he dwelt upon the advisability of making chemists good craftsmen. At its close, he was accorded a hearty vote of thanks, on the motion of Sir Henry Roscoe, seconded by Professor Armstrong.

At the opening meeting of the Institution of Mechanical Engineers in Aberdeen on Tuesday last, the President (Mr. T. Hurry Riches) announced that Mr. Charles Hawksley had presented £1000 to the Institution, for the foundation of a scholarship or premium in commemoration of the centenary of the birth of his late father, Mr. Thomas Hawksley, a Past-President of the Institution.

An insulating joint to prevent electrolysis has been used in the 6-inch water-pipe which enters the power station of the Cleveland Electric Railway. According to "Engineering Record," it consists of a large wooden washer bolted between special castings forming adjoining ends of the service. Each casting has an 11-inch flange with eight ¾-inch holes by which it is attached to the service-pipe, and a 13½-inch flange with a dished face and eight 1⅛-inch holes to form the insulating joint. The wooden washer is a piece of hard maple boiled in paraffin, and having on each side a ¼-inch boss which fits into the recess in the face of the flange of the casting. The bolts at the joint pass through rubber hose, and their nuts press on large fibre washers.

PERSONAL.

At the meeting of the Water Committee of the Leeds Corporation last Tuesday, Mr. E. W. Tekrey was appointed Assistant Water Engineer, in succession to Mr. B. Frankland, who has just obtained the position of Manager to the Weymouth Water Company.

On Saturday, the 27th ult., two presentations were made at the Newport (Mon.) Gas-Works to Mr. Thomas F. Canning, on the occasion of his leaving to take the position of Assistant-Manager at the Ilford Gas-Works. The united staff of the secretarial and engineering departments presented him with a handsome dressing-case, and the foremen and workmen (indoor and outdoor) with a gold watch; and both staff and workmen accompanied these presentations with the expression of their very best wishes for the future welfare of the recipient. Mr. Canning feelingly replied—thanking all for their handsome and unexpected gifts, and stating that he could never forget the great kindness the donors had always shown him, more particularly on that day.

SOUTH METROPOLITAN GAS COMPANY.

Half-Yearly Report.

The following is the report of the Directors of this Company for the half year ended the 30th of June, which, with the accounts (see p. 402), will be presented to the proprietors at the ordinary half-yearly meeting on the 14th inst.

The great increase in the cost of coal under the new contracts, and in the rates, has compelled the Directors, much against their will, to increase the price of gas from Midsummer from 2s. to 2s. 3d. per 1000 feet. The reasons for, and the effect of, this action are explained in a notice to the consumers. Suffice it to say that under the sliding-scale (which extends to the employees) consumers, shareholders, and employees share in all losses and gains. The dividend payable at a 2s. 3d. price is 8s. per cent., or £25,700 a year, less than with the price at 2s.; but the actual reduction of dividend next year will only be 3s. 4d. per cent., or £10,700 a year, because the shareholders, although entitled to £5 14s. 8d. per cent., have for the last three years foregone £15,000 a year—only 5½ per cent. nominal having been paid. The nominal dividend, however, is not the actual rate of interest the shareholders get on their investment, because Parliament decreed, by the imposition of the auction clauses in 1876, which require all new gas capital to be issued at the market value, that henceforth gas shareholders should have only the market rate of interest on their investment, which is below 4½ per cent. The Directors mention this because to this day, after 31 years, there is a common and utterly erroneous impression that gas shareholders are in receipt of high dividends. The employees also, under our co-partnership system, receive a certain percentage on their salaries and wages dependent on the price of gas. When the price rises, their bonus falls, and *vice versâ*. They have always had their full bonus. The increase of price reduces it by 2¼ per cent., from 9¾ to 7½ per cent., or from £45,000 to about £35,000 for the ensuing year. Thus all the parties interested are partners in adversity as in prosperity, and it is the interest of shareholders and employees alike to serve their customers—the consumers—well, by selling gas at as low a price as possible. Such a triple partnership is surely the ideal system of trading.

Compare it with the coal trade. Coal owners and coal miners alike are interested, as their present action shows, in getting the highest possible price for their commodity. No bodies of men are better able to take care of themselves; yet, to enable them to increase the export of coal, Parliament repeals the coal tax, which the foreigner paid, and, by aiding him, the price in the home market is increased. Parliament also introduces Eight-Hour Bills, which, if passed, will increase the cost of getting coal; while the interest of the consumer of coal, which means every individual in the country, is ignored and forgotten. In this matter, the interest of the consumer of coal—be he a manufacturer or a railway, water, gas, or electrical company, or the domestic user—is paramount. If the users of coal—that is everybody—forgetting that everybody's business is nobody's business, do not press their claims on Parliament in opposition to the efforts of interested parties and faddists, the position is in great danger of going by default. For this reason the point is mentioned here.

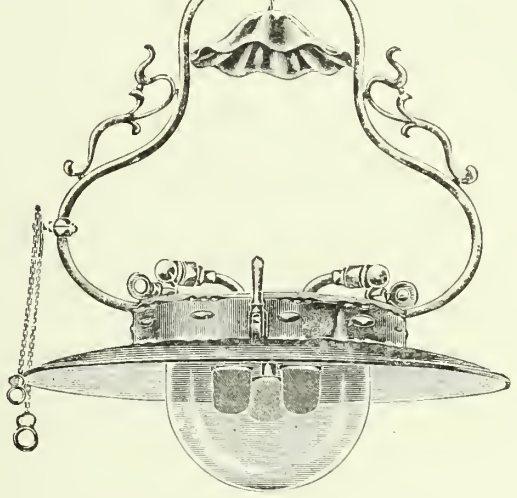
The accounts are satisfactory. More than three-fourths of the coal used in the half year was under last year's coal contracts; while the receipts for products were better all through the half year, and there was an increase of 2·6 per cent. in the gas-rental. Thereby the deficiency of £9364 on the December accounts has been made up, and there is a small balance to carry forward. The Directors therefore recommend the same dividend as has been paid for several years past—viz., at the rate of 5½ per cent. for the half year. The dividend payable next time will be at the rate of £5 6s. 8d. per cent.

The system of rating gas companies could not be more unsatisfactory, confusing to the last degree, understood by no one, and perhaps least of all by the Courts of Quarter Sessions who hear the appeals; for opposing surveyors give free play to their imaginations, with the result that estimates vary enormously. The common impression that gas shareholders are in receipt of high dividends, referred to above, has a mischievous effect on the minds of rating authorities. They are doubly mistaken. Shareholders do not get large interest on their investment, and do not bear more than a small part of the burden of heavy rates or high-priced coal. Under the sliding-scale, while the consumer gets about seven-eighths of all savings and economies in working, he also pays the same proportion of all increases in the cost of working. In regard to rating, it matters little to the shareholder what is paid in rates, because not less than seven-eighths of the amount is transferred to the consumer, who is also the ratepayer; consequently he loses by having to pay more for his gas, *plus* the loss resulting from paying extra rates in this unfair and roundabout way.

If the Company's position is, to an extent, war without, it is peace within. The consumers are well disposed towards the Company; and the employees of all ranks are loyal and interested in its welfare. Of course, in both, there are here and there exceptions; but, speaking generally, the relations are very satisfactory. The partnership in management by the employee Directors, after nine years' experience, has answered the most sanguine expectations. The first scheme was for three years and the second for nine years; but the Directors now think it desirable to make the system permanent, of course with power to the shareholders to terminate it should it not continue to answer its purpose of promoting a true union between employers and employed. They will therefore submit a scheme for the purpose to a special meeting of the proprietors to follow the ordinary general meeting on the 14th of August. A copy of the proposed new scheme will be sent to any shareholder on application to the Secretary.

THE "INVINCIBLE" CLUSTER LAMP.

The increasing popularity of the inverted burner for shop lighting has induced Messrs. Falk, Stadelmann, and Co., Limited, to add another lamp to the many which already exist for this purpose. In designing the "Cluster" lamp shown in the illustration, they have profited by the experience obtained in the past, with the result that the lamp presented embodies all the features which practice has proved to be indispensable.



The lamp, as will be seen, is constructed for three burners of the bracket type, which are so arranged that the mantles are in close proximity to each other—producing, with the aid of the reflector, a powerful downward light, evenly distributed, while at the same time the radiated light is sufficient to prevent any shadow being cast on the ceiling. The burners are controlled by a single lever cock, conveniently operated by chains. Each burner is, in addition, provided with an auxiliary tap as a check on the gas supply, enabling this to be regulated to suit local conditions of pressure, &c., and further admitting of the use of less than three burners at will. The bowl is supported by a cast hinged ring above the reflector. The light is thus unobstructed and perfectly shadowless. The burners can be readily reached by opening the bowl, for mantle renewals, &c. The air chambers of the burners are fitted with a gauze sleeve; thus effectually preventing foreign matter being drawn in at the port-holes with the primary air intake, and thereby keeping the burners perfectly clean. The lamp is specially suited for drapery establishments, show-rooms, offices, and similar places, where a brilliant, steady radiance, without shadow, is required.

The death is announced, in his 74th year, of Mr. Joseph Peel, of Wellfield House, Yeadon. Deceased was Chairman of the Yeadon Water Company.

A FRENCH ENGINEER'S INSTRUCTIONS FOR THE MANAGEMENT OF REGENERATIVE FURNACES.

(*Concluded from p.* 313.)

Management of Producers.

The good management of producers is of great importance; and as it depends on the nature of the fuel and of the system of grate adopted, it may be of use to give some details on the working of: (A) Grates with stepped fire-bars, fed with unpicked coke; (B) of grates with horizontal fire-bars for double regenerative furnaces; and (C) of grates with hinged bars intended for burning mixtures of coke dust and small caking coal.

(A) *Producers having Grates with Stepped Fire-Bars* (figs. 1, 3 and 4*). Grates with stepped fire-bars are at present the most generally employed for burning unpicked coke, coal by itself, or mixed with a certain amount of coke, and mixtures of various fuels. Such grates are particularly suitable for simple regenerative furnaces, and allow of using with the coke from 10 to 25 per cent. of coke dust. For this to burn suitably, the dust ought to be mixed with the coke, not merely thrown on with a shovel above the charge of coke. It is advantageous to add a little coal dust or coal sweepings to the mixture.

According to the nature of the coke used and the dimensions of the producer, the complete clinkering—that is, using the false spear bars—ought to be done every twelve, twenty-four, thirty-six, or forty-eight hours. When some coals are being carbonized, which give coke the clinker of which can be got out by merely pricking the fire, clinkering with false bars need only be done once or twice a week; but in such a case it is necessary for the producers to have a grate area amply sufficient, and for the intermediate prickings to be done regularly. To facilitate the complete clinkering, a certain number of square or flat wrought-iron bars, pointed at their ends, are pushed in between the top space of the stepped fire-bars, so that there is formed a sort of false grate, nearly horizontal, on which rests the coke contained in the producer. Then the stepped fire-bars are taken out, in order to be able the more easily to withdraw the clinker. The clinkering being finished, the stepped bars are again put back, the false grate-bars are withdrawn, and the producer charged. The false fire-bars can be hammered straight at once on being withdrawn from the producer. During the whole time of the complete clinkering, it is well to half shut the waste-gas dampers or to open wide the secondary-air slides, so as to reduce the amount of unburned carbonic oxide gas which will escape as a pure loss through the chimney.

The light clinkering or pricking, without false fire-bars, is done simply with a spear or pricker and a rake every six, twelve, or twenty-four hours, according to the nature of the fuel, and the dimensions of the grate. The clinker taken out can be left in the basin of the producers until the complete clinkering be done. In the interval of the light clinkering—that is to say, every two or three hours—a rapid poking and clearing of the fire ought to be done; thus causing the cinders, which accumulate on the fire-bars, to fall through. When the clinkering of the grate is badly or incompletely done, sometimes choking-up of the lower part of the weir or seal (where there is one) of the producer results. It is then necessary completely to empty the producer, and to take out with crowbars the hard clinker which impedes the gas outlet from the producer. The entire emptying of the producers is seldom necessary, and it is best to do it only when the temperature of the bed goes down without reason.

The producer ought always to be kept nearly full of coke, and the charge of coke ought never to be allowed to get below the bottom part of the weir or seal (where there is one). It is this necessity of keeping a sufficient depth of fuel, so as to avoid direct-firing in the producers, which generally leads to the giving up of the use of hot coke for feeding producers of average capacity. Direct firing can, in fact, only be avoided by maintaining above the bars an average thickness of fuel of at least 60 centimetres (or 2 feet). When the producers are placed inside the main structure of the bench, a good precaution is to finish up the charging of the producer with a few shovelfuls of pure coke dust, or mixed with a little coal dust. This prevents the heating and disfiguration of the producer lids through the heat of the incandescent coke.

It is further necessary to watch attentively that the feeding door of the producer shuts tightly, so as to prevent the ingress of cold air if the bed is under a vacuum, or, if the bed is under pressure, or fluctuating, to prevent the issuing flames making the cast-iron door red hot. Again, the stokers must be told not to throw water on to the producer lids at the time of drawing the retorts. [This remark applies equally to the retort mouthpieces.] Generally the producers ought to be charged every two or three hours—that is, once in between the retort charges, which it is easy to do when all the retorts are not charged at the same time, as is the rule in all well-conducted works.

Water ought constantly to be running into the angle-iron sprinkler, and to be falling drop by drop into the basin of the producer, which should always be moist, and even covered with a light and thin film of water. This water sprinkling produces a gas of good quality, prevents the formation of clinker, and assures a longer life for the fire-bars and other iron parts of the producer. It is useless and even harmful, to allow the producer basin to be filled up and to let the water flow outside, for the water is intended to be evaporated.

The producer ought always to have its furnace door shut—except, of course, during clinkering and pricking. The ventilator openings of the door are more or less open according as to whether one wishes to quicken or retard the production of gas. But, as was said before, it is better to have the ventilator openings amply open, and to regulate the admission of gas by means of a special damper, or by simply manipulating the air and waste-gas dampers.

(B) *Producers having Grates with Horizontal Fire-Bars for Double Regenerative Furnaces* (fig. 5*).—Clinkering is done every twelve or twenty-four hours according to the quantity or nature of the clinker made. A false grate is always used for it, which is carried on a support or on a transverse wrought-iron bar. In the intervals of clinkering, it is enough to clear the cinders about every two hours by lightly knocking the underside of the fire-bars. The cinders which accumulate in the bottom of the producer are rather more difficult to get at; but it can be done by passing a sufficiently long rake between the bars. Every six hours it is a good thing to pass a clinker-bar into the bed of fuel, and take away the small clinker that may be found in front of the grate. Care must be taken that the boilers or vaporizers and the ash-pan be always full of water, in the absence of which there is risk of their becoming deteriorated and of the grate becoming red-hot and misshapen. The cinders which drop into the bottom of the ash-pan can be taken out by a special shovel. When, for one reason or another, the vaporizers have to be taken out, the furnace-door must be left half-open and the secondary-air slides opened a little, because, in this system of furnace, opening the furnace-door very considerably increases the amount of gas which arrives at the nostrils. The bed then works, as also during the clinkering, as a simple regenerative furnace; for air no longer passes into the bottom of the regenerators, and there is no hot air arriving under the grate. In ordinary working, on the other hand, the furnace door must be hermetically closed, so that hot primary air—either by itself or else mixed with steam—will be supplied under the grate-bars.

During the drying and gaseous firing of these beds with double regeneration (which are carried out as for those with simple regeneration), the steam from the vaporizers is allowed to escape into the producers by merely taking off the covers of the boilers or vaporizers. These covers are replaced only when the furnace door is to be shut, after having effected the gaseous firing of the bed. A good way of avoiding the rapid eating away of the nose of the producers is to lead to it the steam from one of the vaporizers. The management of double regenerative furnaces is naturally a little more difficult than that of beds with simple regeneration; but it is not necessary to exaggerate this difficulty, which can be easily surmounted by requiring the stokers rigidly to follow the instructions given to them.

(C) *Producers having Grates with Hinged Bars for Burning Coke Dust mixed with 30 or 40 per Cent. of Small Caking Coal* (fig. 6*).—The drying and gas firing of these furnaces are done in the same way as for beds having stepped fire-bars and for double regenerative furnaces. Clinkering with a false grate is effected, also, as with double regenerative furnaces, that is every twelve or twenty-four hours, with this difference, however, that it is rather easier on account of the greater height the fire-bars are above the ground. As for the lighter clinkering and pricking, they also are done easier; for it is enough to give a slight shaking movement to the grate with a clinker-rod in order to cause the cinders to fall and the clinker to separate. This clinker can be raked out by taking out the lower bars of the small stepped fire-bars which are placed above the horizontal grate. The stepped fire-bars enable a false grate to be used for the complete clinkering.

They are an improvement, dating from 1893, on the original patented idea of M. Radot, which dates from April, 1889. Experiments were made on this furnace at the Saint Quentin Gas-Works; and the Manager, M. Frère, read a paper on the system before the Société Technique du Gaz en France in the year 1890. In the different cases which present themselves in actual practice, there is reason to examine and see if the supplementary work imposed on the stokers in order to burn coke dust is not balanced by the advantage of burning a fuel of small value. It is also to be observed that coke dust is generally used for the production of steam, and that 15 to 20 per cent. of coke dust can be used in ordinary producers provided with simple stepped fire-bars. Gas firing of the bed having been started in the usual way—that is, by using ordinary coke, and the bed being brought to nearly its normal temperature, the grate can then be charged with a mixture of small caking coal and coke dust. This charging is to be done in the following way: Every half-hour the sloping floor of the producer is fed through the charging door with 25 to 30 kilos. (56 to 66 lbs.) of fuel. The previous mixture, which will be almost completely caked, can be pushed down by a rod to the bottom of the

* See *ante*, pp. 310-11.

* See *ante*, p. 312.

producer. The pieces of coke formed in this way are sufficiently spongy for the purpose of transforming CO_2 into 2CO under good conditions, which cannot be done, for example, with briquettes, on account of their great density.

In order to avoid air getting in over the bed of fuel, which would have the effect of partially burning the gas produced and of raising the temperature of the inside of the producer to an exaggerated degree, care must be taken that the stokers break into sufficiently small pieces the kind of crust that is formed on the slope of the producer; and the arching that is formed over the grate must also be broken up and made to fall down. When the producers project in front of the façade of the bench, this can be easily done by arranging convenient holes for poking; but it can also be conveniently done, when the producers are within the main walls, as shown in fig. 6, through the producer feeding door. The inconveniences of a high temperature in the interior of the producer are the same as those which arise from working with a direct fire in ordinary producers; and it is necessary to try to reduce this temperature as much as possible in order not to deteriorate too quickly the producer arch. It will be seen, on looking at fig. 6, that the middle bottom retort is made to rest on the arch of the producer itself, in order to cool the arch a little, as it would otherwise be between two fires. In producers for burning coke dust, doors supplying a double current of air to the fire-bars are generally replaced by a simple screen, which hangs from an angle-iron placed in front of the furnace.

The management of producers fed simply with coal is analogous to that of producers charged with coke dust, inasmuch as it is necessary to charge them very frequently so as to have a regular giving off of gas, and to avoid bursts of flame against the retorts and in the producers. These producers are generally provided with a grate with stepped fire-bars; and their weir or seal-wall (if there be one) is placed at a greater height above the grate. Inconveniences inevitably arising from burning coal can be got over by mixing with it 50 per cent. of coke.

It may here be observed that producers having horizontal grates produce more clinker than producers with stepped fire-bars, because the evaporation of water from the ash-pan of the former producers is much less active. They also give a less rich gas. In small works where the heating of the beds by a mixture of coal and coke dust is generally replaced during the night by using coke only, there is therefore a certain disadvantage in adopting horizontal grate bars, whether hinged or not.

Cleaning Out Regenerators.

Regenerators in which the gases circulate horizontally ought to be cleaned out once a month. To do this all that is required is to pass a small wrought iron scraper through the sight-holes in front of the regenerators. When the gas-flues are very long, or there is not much space in front of the regenerators, small lengthening pieces can be screwed on to the end of the scraper. During the cleaning out, it is well to moderate the heat of the bed by half-closing the waste-gas dampers. As soon as the cinders deposited in one flue have been taken out, the sight-hole plug must be put back; care being taken to see it is luted all round, so as to prevent cold air getting in.

The cleaning-out of regenerators, which are arranged so that the waste gases pass through holes in special blocks, need only be done every two or three months, because the greater part of the cinders is deposited on the top of the highest tier of blocks, and eventually forms a sort of ridge, which generally falls by itself into the bottom of the regenerator when it has reached a certain size. Cleaning out in this case consists merely in making the ridge fall down by using a hook. To keep the small vertical passages perfectly clean, a good practice is to open and to shut the waste-gas dampers in the bottom of the regenerator a certain number of times, so as to cause a violent current of gas to pass through the vertical ducts. During this operation (which can be done once a month), the feeding door of the producer and the plugs in the front wall of the bed are generally opened. Again, when, for one reason or another, the regenerators have become blocked up, the small vertical ducts can be cleared by throwing a bucket of water on the top of the regenerator. If this is not done too often, it has no effect on the life of the special blocks, which are brought to a sufficiently high temperature for the phenomenon of calefaction to be produced.

In regenerators where the waste gases circulate along the length of the retorts, cleaning-out is only done at the end of a season—that is, when retorts are being renewed—because, owing to the long passage of the gases, nearly all the cinders drop into the bed itself, which is of considerable advantage in inclined retort systems.

When retorts are taken out from a bed, it is, of course, necessary to cover the openings in the special blocks with laths or small planks so as to prevent the vertical passages from getting stopped up with refractory rubbish. Such rubbish can be cleared out through the sight holes at the bottom of the regenerators; but it is better to prevent it falling into the holes, where it may stick. After the retorts have been taken out, all the small vertical ducts must be swept out with a suitable rod.

If properly built, regenerators should be perfectly tight. If an analysis of the waste gases shows that this tightness has not been achieved, it will be necessary, after having dropped the temperature of the bed a little, to wash the horizontal flues of the regenerators with a thick mop dipped in a fairly clear grouting. The space available for the regenerators being comparatively restricted, gas-works' retort-beds have not too much regenerative surface. Indifferent results are sometimes obtained through endeavouring to increase this surface, while at the same time the regenerators are not made tight—the risk of bye-passing being, of course, increased by the greater length of the waste-gas flues.

Letting Down a Bed.

Putting a retort-bed out of action is effected as with a direct-fired furnace. The producer being half-filled with hot coke, all the dampers are shut, and all the openings of the bed including the furnace doors are luted, and the bed is allowed to cool down slowly. The water supply to the producer must, of course, be shut off. The retorts should be charged for a last time an hour or two before closing-down the bed. When the bed has cooled down and the retorts have been drawn, the ascension pipes should be plugged up. Where there is a hydraulic main to each bed, its gas-valve can simply be shut.

Self-Sealing Retort-Lids.

At the time of lighting up beds of retorts, mouthpiece bolts have always a tendency to expand with the heat; and it is a good thing to see that they are tightened up again. The cleaning of the inside of the lids can be done with a small iron scraper. For the machined edges of the lid and mouthpiece, it is better to use a copper scraper, with which there is less risk of damaging the surfaces. At the time of mounting retort mouthpieces, it is well to grease the eccentrics of the self-scaling lids with plumbago.

Ascension and Arch Pipes.

When the beds are working at a high temperature, the cleaning out of the pipes should be done methodically and before the obstruction has been formed. One man is enough to keep the pipes and hydraulic main of four or five beds in proper condition. In order that the stokers may not be inconvenienced by the flames or gas given off, the cleaning of pipes should be done when the carbonization is nearly completed—that is to say, 15 to 20 minutes before opening the retort-lids for the draw. If an ascension pipe is badly stopped up, the cleaning-out can be postponed until the retort is drawn, when the obstruction can be burnt-out if necessary. With certain coals which cause but few stoppages, or when the beds are not forced too much, the cleaning-out of pipes can be done by the stokers, because the tar condensing in the ascension pipes collects the pitch and soot, which fall into the retort mouthpiece. It is, however, always necessary to see that the stokers pass a gouge of suitable size into the bottom of the pipes at each draw, because it is very important to keep the bends of the ascension pipes properly free and clean.

Arch-pipes can be cleaned by inserting a sort of sheet-iron scoop into which the pitch and soot are scraped by a scraper. This scoop ought to be long enough to prevent the detached pieces of pitch from falling into the hydraulic main. Another method, adopted in small works, consists in putting into the arch-pipe a fixed thin sheet pipe split in half, and provided with a handle. When this pipe is full of pitch, it is taken out, and another inserted, which thus saves a good deal of time.

Hydraulic Mains—Various Observations.

Cleaning out the hydraulic main ought to be done regularly with a special rake with curved handle, which allows the rod to be conveniently worked from the cleaning-out doors. Thus the pitch which is always deposited after a certain time in the bottom of the hydraulic main can be taken out. When the cleaning out is finished, care must be taken that the covers of the hydraulic main are well luted and replaced, so as to avoid any loss o ammonia. Every morning it is a good thing to run off very slowly a certain amount of thick tar from the bottom of the hydraulic main. At the same time, care must be taken to run into the main an equal volume of water to that of the tar which has been withdrawn.

As the amount of thick tar taken out every day is rather small, sometimes no water is let into the hydraulic main; but it is then necessary only to take out just the thick tar required, say, 20 litres (about 4½ gallons) per bed. For the good working of the hydraulic main, it is convenient (especially where there are high heats), to have a small stream of ammoniacal liquor flowing in at the opposite end to that of the tar-regulating valve, so as to ensure that the dip-pipes shall be sealed in liquor and not in tar. When a hydraulic main is started to work, it is always wise to increase the seal temporarily before sending gas into it from the retorts. The seal can be, for example, 7 or 8 centimetres (about 3 inches), so as to prevent any chance of accident.

It is generally advisable not to push too far in the matter of carbonization; not only because of the reduction in illuminating power, but also for a variety of other reasons—pipe stoppages, formation of thick tar in the hydraulic main, production of naphthalene, shorter life of retorts, larger consumption of fuel, &c. When the ascension pipes begin to get stopped up in an abnormal way, it is an almost certain sign that the beds are too hot, and it is only necessary to close down the draught dampers a little to put everything once more in order.

When the settings have 20-feet "through" retorts, as shown in fig. 4, it is always better, in order to avoid stopped ascension pipes, to have only one gas-outlet pipe of a sufficiently large diameter—say, 7 or 8 inches—and but one hydraulic main per bed. If the charging is done by a coal-projecting machine, and

the coke discharged by a pusher (of the De Brouwer or other type), stoppages and thick tar can be avoided by nearly completely filling up the retorts, and carbonizing the charges in eight hours. With well-proportioned and suitably-heated retorts, these heavy charges do not appear to lead to any inconveniences either as regards make of gas per ton or illuminating power. Besides, they give coke of a denser quality; and scurfing retorts is almost entirely done away with.

It is necessary to arrange that the retorts shall be drawn as soon as the charge is sufficiently burnt off, and that care be taken not to heat the bottom of horizontal retorts too much, or the top of inclined retorts, which leads to a considerable reduction in the lighting power. An excellent practice is not to charge the retorts all at once, and to allow, in small works at all events, a certain liberty to the stokers in carbonizing a given amount of coal in a given time. The carbonization thus becomes fractionized, and instead of having large volumes of gas at certain hours of the day (which may cause some plant to prove insufficient), there is a nearly constant make of gas.

In the manufacture of gas, everything hangs together; and it only requires something to be wrong in the management of the retorts and furnaces for all the rest to go wrong as well. It is therefore for the carbonizing foreman thoroughly to understand the conditions to be aimed at to obtain good results from his retorts, in order that he may be able to remedy at once any inconveniences that may arise in consequence of a change in the coal used, or for any other reason.

THE CENTENARY OF GAS LIGHTING.

(*Continued from p.* 159.)

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We now come to a rather important stage in gas lighting, so far as it concerns the Metropolis, when three of the Companies—viz., the Chartered, the Central Consumers', and the City Company—were brought under the City of London Gas Act, 1868, in which the views of Lord (then Mr.) Cardwell's Committee were substantially incorporated. This Act did not fix a standard price, but a maximum price of 4s. to Jan. 1, 1870, and after that date of 3s. 9d. The following are some of the principal provisions in the Act.

The price was subject to revision by the companies every subsequent January, by appeal to the Board of Trade, if either required. The candle power was raised from 12 to 16; and should the companies reduce the illuminating power below 16 candles, they were to give the consumer a reduction in price of 2½d. per 1000 cubic feet for every candle reduced. The price was never to be higher and the illuminating power never under the Act of 1860—4s. 6d. and 12 candles. Payment of back-dividends was not permitted. The Act defined the burner by which the illuminating power of gas was to be determined. The appointment of Referees by the Board of Trade to prescribe mode of testing, &c., was provided for. By sections 18 and 19, power was given to the companies to draw up schemes for amalgamation. The schemes of the companies desiring amalgamation were to be "framed with a view to the reduction of the expenditure" of the companies. All amalgamation schemes that afterwards took place were subject to this clause. Power was also given to purchase the undertakings of the companies supplying the City, within three years of the passing of the Act, which powers were allowed to lapse.

In concluding their labour, the Gas Committee of 1868 referred to the "satisfactory termination of the contest" in which they had been engaged during three sessions of Parliament. They stated that they had to contend, not merely with Metropolitan Gas Companies, but with the combined parliamentary power of the gas interest of the whole of the country.

In September, 1867, an interesting pamphlet was issued dealing with the labours in Parliament of the authorities during that session in connection with the Bills of the Imperial and the Chartered Gas Companies. The pamphlet was a reprint from the "Journal," and was published for distribution. It contained the speech of Mr. Bontems, the Chairman of the Special Gas Committee, in which he continually refers to the "Journal." For instance, he says: "Then look at the money spent in agitation! The 'Journal of Gas Lighting' says that £100,000 have been lost in parliamentary expenses since the year 1857."

With regard to the revision of prices, there were only three applications between 1868 and 1876—one in 1873, and two in 1874; and there is no doubt that they were brought about by the great coal famine in the early seventies. This famine, which began in 1872 and lasted till well into 1874, was at its worst in 1873, when prices had increased more than 100 per cent. It will be noticed that, by this Statute, the Revision Commissioners were directed to have regard to the question of management, and were only to allow such a price as would yield 10 per cent. profit consistent with "due care and management."

In 1867, the consumption of gas in the Metropolitan area was increasing at an enormous rate. The quantity supplied to the large district served by the Imperial Company doubled every ten years; and as the establishment charges were not increasing in the same ratio, the cost of supply per 1000 cubic feet was naturally diminishing. The following table shows how a very largely increased supply of gas was furnished without a proportionately increased expenditure by the Western Gas Company, for a period before 1856 and 1866:—

—	December, 1856 (before Districting).	December, 1866.	Difference Per Cent.
	£ s. d.	£ s. d.	
Share and loan capital per £100 income	531 9 0	317 9 0	40·2
Share and loan capital per £100 gas-rental	608 7 0	364 8 0	40
	Cubic Feet.	Cubic Feet.	
Gas made	138,000,000	410,000,000	197
Total income	£41,754	£108,651	160
Number of consumers	4,799	11,700	144
Amount required for dividend and interest per 1000 feet of gas made	d. 35·04	d. 18·35	47·6

In the early part of 1868, there was issued an extremely interesting pamphlet entitled "London Gas Companies and Gas Consumers—an Important and Exhaustive Article on this Great Public Question;" being reprints from the "Daily News" of that year. The title-page had on it the following: "Great misapprehension exists on the Gas Question; a portion of the Press—and notably the 'Saturday Review'—having accused those who sought, and still continue to seek, for a reform in this gigantic monopoly, of a desire for confiscation. A Committee of the House of Commons, presided over by an experienced and distinguished statesman, have investigated the matter, and have arrived at a conclusion still more unfavourable to the Gas Companies. This report has produced a renewed cry for confiscation, and an elaborate defence of the Companies by a Director of the Imperial Company—the largest, and, as last year's evidence showed, most unfair in its dealing with the consumers, of these great and uncontrolled monopolies. Four articles having lately appeared in the 'Daily News,' written by an unknown hand, and these articles stating the position of matters with great accuracy and impartiality. permission was asked of the proprietors of that newspaper, and at once readily given, to reprint and circulate them. They charge to private consumers 4s., to the rich parish of Marylebone 2s. 11½d., and to the poor parish of Clerkenwell 3s. 7d. for the same quality and quantity of gas." One interesting point in the pamphlet is the cost of gas, at this time (1868)—viz., it being certified by the Engineers of five of the greatest London Companies to be 11½d. at the works. One Company, the West London Junction, who supplied all their gas to one consumer, had sold gas since 1859 at 2s. 10½d. per 1000 cubic feet, and were prepared to sell any quantity at that price.

In this year also (1867) an interesting return was published giving the capital and dividends for the thirteen Gas Companies supplying the Metropolis during 1866.

—	Paid-up Capital.	Dividend Distributed.	Rate of Dividend. Per Cent.
	£	£	
Chartered Gas Company	810,000	70,779	8¾
City of London Gaslight and Coke Company	388,000	29,312	10, 8, and 4
Commercial Gas Company	437,220	43,718	10
Equitable Gaslight Company	300,000	29,095	10
Great Central Consumers' Company	200,000	20,000	10
Imperial Gaslight and Coke Company	1,355,985	130,308	10 and 7
Independent Gaslight and Coke Company	187,500	15,890	10, 7½, and 5
London Gaslight Company	617,476	46,483	10, 6, and 5
Phœnix Gaslight and Coke Company	774,000	65,925	10, 7½, and 5
Ratcliff Gaslight and Coke Company	100,000	10,000	10
South Metropolitan Gaslight Company	222,950	20,682	10
Surrey Consumers' Gas Company	199,998	18,999	10 and 9
Western Gaslight Company	300,000	29,166	£9 18 10

During 1868, a very strong pamphlet was issued by Mr. C. G. Cleminshaw, the Engineer of the Manchester Gas-Works, entitled the "Gas Supply of the Metropolis: A Word to the Public, the Companies, and the Shareholders." It was a scathing indictment of the thirteen Gas Companies of the Metropolis. In one place the author says that if the 1868 session had been futile, the Companies had been threatened with a Bill by which the consumer would have been supplied with 18-candle power gas at 3s. 6d. per 1000 cubic feet.

There was also an article dealing with the question of the 10 per cent. dividend of the Gas Company. It stated—

The present arrangement is one that relinquishes all the ordinary guarantees which should surround the interest of the consumer arising from competition, and makes over that increased value which the growing wealth of the community confers upon the trade of gas making entirely to the companies. In contrast with this system, we may mention that followed at Manchester. In this city, works have been constructed at a cost of £760,000, while the working capital may be taken at £50,000; but as the property was in the hands of the Corporation, the profits have been applied from time to time to redeem the capital, so that the bond debt is now only £347,472—a sum of £462,711 of the capital of £810,000 having been redeemed. Manchester was supplied in 1865 and 1856 with 22-candle gas at 3s. 2d. It is not alleged that the London Companies can or should be required to supply more than 18-candle gas at that sum—though Mr. Cleminshaw, formerly

Manager of the Manchester works, told the Committee of 1866 that a 22-candle gas might be supplied for 3s.—but inasmuch as the Companies have compared the capital on which they have to pay dividend with that on which interest has to be paid at Manchester, it is impossible to resist the temptation to observe that it makes all the difference to the body of consumers whether the profits made by their consumption are carried to a fund by which they will be permanently benefited, as at Manchester, or whether the process is to go on for ever for the advantage of a body of monopolists who can render no service to the community which it is not well able to perform for itself. Before any permanent arrangement can be arrived at, it will be necessary for the representatives of the London Companies to accept the fact that the public remains in full possession of its original liberty to provide for its own gas supply, and that any unreasonable insistence upon a supposed vested and guaranteed interest in the requirements of the public must inevitably lead to the loss of the special advantages they now enjoy. The language and attitude of the Companies are quite unseasonable; and they must be reminded that they exist for the consumers, not the consumer for them."

During the session of 1868, the Gaslight and Coke Company promoted, and obtained the Royal Assent to, a Bill consolidating their previous Acts, and had their Charter and bye-laws annulled. The provisions of the City Gas Act were inserted in it to cover the undertaking throughout the Metropolis; the Metropolitan Board of Works being made the Authority. Similar provisions were put in the Imperial Act of 1869, and the South Metropolitan Act of the same date. The prices and illuminating power of these Companies at this time were—

	Price. s. d.	Candle Power.
Imperial	3 9	14
South Metropolitan	3 6	14
Gaslight and Coke	4 0	14
Commercial	4 0	14

The Commercial, London, Independent, Phœnix, Ratcliff, and Surrey Consumers' Companies were not affected by this legislation of 1868-9.

In March, 1868, an improvement was reported with regard to sulphur compounds in the London gas; and it was stated that, "if the present practice of using lime for the purification of gas be carefully followed out, as Mr. Hawksley and Dr. Letheby recommend, the quantity of sulphur will no doubt be under the amount sanctioned by Parliament." In September, 1868, Dr. Letheby further stated: "The marked decrease in the average proportion of sulphur in the gas of the Great Central Company is evidently due to the improved method of purification." This was the last report of Dr. Letheby on the quality of the Metropolitan gas; the Board of Trade having appointed him Chief Gas Examiner. In concluding his report, Dr. Letheby said: "I cannot but regard my appointment as a mark of respect for you, not merely because the Act applies to the City, and has been obtained by your exertions, but also because it is here, and here only in England, that for nearly 17 years there has been a constant and systematic examination of the gas supplied to the public. In the performance of this duty, much useful knowledge has been acquired, and many valuable facts recognized." Thus passed away from the field of active controversy the one man who had left his mark upon the legislation of nearly two decades.

In June, 1869, a statement was issued to the Metropolitan Board of Works by Mr. T. W. Keates, F.C.S., in which reference to the late Mr. W. Sugg's "new argand burner" is made. The author states: "By this burner, the lighting power of common gas is raised, according to report, in the proportion of 100 to 116. As, however, an argand burner of this description is not suitable for ordinary use, and the fishtail is for several reasons likely to be retained as the common burner for the public, I submit it is not fair to the consumers that such a new burner as the new argand burner should be used as a standard, unless they were generally enabled to avail themselves of its advantages. As it is, they must be content with the fishtail, which, even of the best construction, gives only 89 per cent. of the light of the old argand. Compared with the new argand, the light given by the fishtail burner is only 89 out of 116. The fact is that, by the alteration of the standard, the gas gains 16 per cent., leaving the consumer no better off than he was before. The effect will be that the examiner will be obliged to report 16 or 14 as the photometer value, while 14 or 12 candles respectively will be what the public will get."

Amalgamations were now the order of the day. In 1870, the Gaslight and Coke Company purchased the Victoria Docks Gas Company. They also amalgamated with the City of London Company in March, and the famous Great Central Consumers Company in July, of that year, and in 1871 with the Equitable Gas Company.

In connection with the amalgamation of the Great Central Company with the Chartered Company, it came out that one of the reasons why the former had not been able to pay a dividend was owing to the very serious defalcation of one of the officers. So serious was it, that it was set out fully in about two pages in the Act of Parliament or Order in Council amalgamating the Companies in 1870, and was referred to in Parliament again later on. It is presumably the only instance of a defaulter having so much space given to him in an Act. It was referred to as the "Higgs' Defalcation Account." It appears that there was an accountant, or some other officer, of the Company, named Higgs, who had, over a number of years, made away with a sum of between £70,000 and £80,000; and the Company were allowed to put the deficiency to a suspense account and liquidate it by annual instalments of £5000. On the amalgamation, a clause was inserted that on June 30 and Dec. 31 each year, until the deficiency was discharged, the United Company, before payment of any dividend, should carry to the credit of the defalcation fund £2500.

In 1872, the Gaslight and Coke Company went to Parliament for additional capital and new works; and in 1873, with a selling price of 3s. 9d., the Company got it raised on revision to 4s. 4d. The Company were in Parliament in 1873, consolidating their Acts of 1868, 1870, and 1871; and they obtained powers to purchase and use collier ships, lighters, vessels, &c. In 1874, they again got their price raised from 4s. 4d. to 5s. per 1000 cubic feet.

It will easily be gathered from the foregoing facts how enormously the business of the London Companies, as amalgamated, was growing, and how extensive their powers were becoming. The local authorities, therefore, again began to be on the watch; and owing to the rise in price, it was decided, by application to Parliament or otherwise, to ensure a satisfactory supply of gas at a reasonable rate. It having been found in practice that the revisions of price by Commissioners were unsatisfactory, it was resolved to introduce Bills into Parliament for entering into competition with the existing Gas Companies by the erection of new works; for the acquisition, by purchase, of the property of those Companies; and for the further regulation of the Companies. Three separate Bills for carrying out these objects were introduced into Parliament, and were read a first time; but owing to the Government not being prepared to support the second Bill, that and the first were withdrawn.

The remaining Bill, however, for the regulation of the Companies, was proceeded with. It was vigorously opposed by the Companies; but on May 13, 1875, its second reading was carried by an overwhelming majority. It was referred to a Select Committee presided over by Mr. W. E. Forster. Sir George Livesey attended, by order of the Speaker, at the instance of the Metropolitan Board of Works, and gave evidence as to the uselessness of existing regulations, and the necessity for a sliding-scale; and he greatly influenced the Committee. He quoted from an address of his own the previous year to show that he had long been of the same opinion; and on June 25, after an immense amount of evidence had been taken, the preamble of the Bill was passed. The Bill was re-introduced in the following session of Parliament (1876), and read a first time. Eventually the Gaslight and Coke Company themselves introduced a Bill, and as it carried out the provisions of the Metropolis Gas Companies' Bill, it became unnecessary to proceed with the latter. In due time this Bill became the Gaslight and Coke Company's Act of 1876; the authorized capital being fixed at £8,265,000.

(*To be continued.*)

The Institution and the Workmen's Compensation Act.

With reference to the sheet of questions issued to the members of the Institution of Gas Engineers on the 16th of July, the Committee having the matter in hand have requested the Secretary (Mr. Walter T. Dunn) to ask, through the "JOURNAL," those who have not yet returned it with the replies inserted to kindly do so as soon as possible, and not later than the 20th inst., so as to enable the Committee to complete the preparations they are making for further action.

The Wolstanton Arbitration Proceedings: A Correction.—In Mr. Arthur Valon's evidence in the above arbitration, as reported last week, the figure given by him for depreciation on meters and stoves, in answer to a question by Mr. Honoratus Lloyd, at the bottom of the second column on p. 339, should have been 20 (not 10) per cent.

The Discussion on Mr. Smith's Paper at the North British Meeting.—In the portion of Mr. W. Prince's remarks on Mr. Smith's paper on "Naphthalene Extraction," given last week (p. 323), in which he referred to his experience at Darlington, the number of complaints should have been given as from 200 to 300 (not 2000 to 5000) per day, from 9000 to 10,000 consumers. When speaking of his make of gas, Mr. Prince said it was 10,700 cubic feet per ton, and the six works in Staffordshire alluded to lay within a radius of two miles.

Decomposition of Cement by Sea Water.—The current issue of the "Annales des Ponts et Chaussées" contains a valuable article by M. Le Chatelier on the action of sea water on cements. It is partly a republication of his article on this subject in the "Annales des Mines;" but he has added a concluding portion on the direct decomposition of cements in saline solutions, which here appears for the first time. According to an abstract in the Engineering Supplement to "The Times," M. Le Chatelier states as his conclusion that all hydraulic binding agents, without exception, are capable of being decomposed by sea water; but that the rate of this action varies within wide limits. It becomes relatively slow when alumina is present only in small proportions. The addition of puzzuolana, especially of calcined clay and of trass of good quality, endows all hydraulic cements with considerably increased powers of resistance to the action of sea water. The most essential condition to render cements immune from decomposition in the sea is to reduce to the utmost the volume of water employed in gauging the cement; and it is here that the effect of puzzuolana, quite independent of its chemical action, becomes of value.

THE PRACTICAL MANAGEMENT OF GAS-WORKS.

By Alexander Yuill, of Dundee.

[A Paper read before the North British Association of Gas Managers, July 25.]

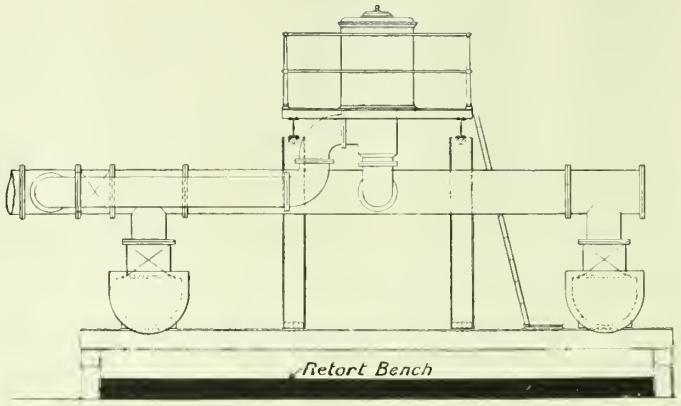
It has often been remarked that some are born to greatness and some have honours thrust upon them. Should you consider my position before you to-day under the latter category, I must appeal to our worthy President to stand as my apologist, as it was only on his urgent demand, which I looked upon as imperative, that I occupy this position before you. I often have had the desire to see some of our younger members stepping upon the rostrum and giving us their experience. They occupy a unique position from the fact that they are untrammelled from all form of superstition which confines the ideas of some who have been enthralled into the chaotic state of use and wont. I have always been a believer in the axiom that "there is often another way of doing things besides the customary;" and the notes I purpose laying before you are more on these lines than as resulting from any spirit of inventiveness.

It is advisable to keep before us the principle that "fortunes are made from savings and not from earnings;" and no department of gas-works offers such scope for the realization of this than close attention to the ordinary work and routine in the retort-house. Regarding retort-construction, the student of gas-engineering has now placed before him for his benefit the investigations and research of the past; leading up from the single retort heated with a form of furnace—the prototype of which, no doubt, was copied from a furnace applicable to the heating of an ordinary wash-house boiler—to the latest examples of regenerative settings for inclined and horizontal retorts of twelve in the settings heated by one furnace, with a minimum of fuel which, no doubt, would have excited the envy of a gas engineer of a bygone age.

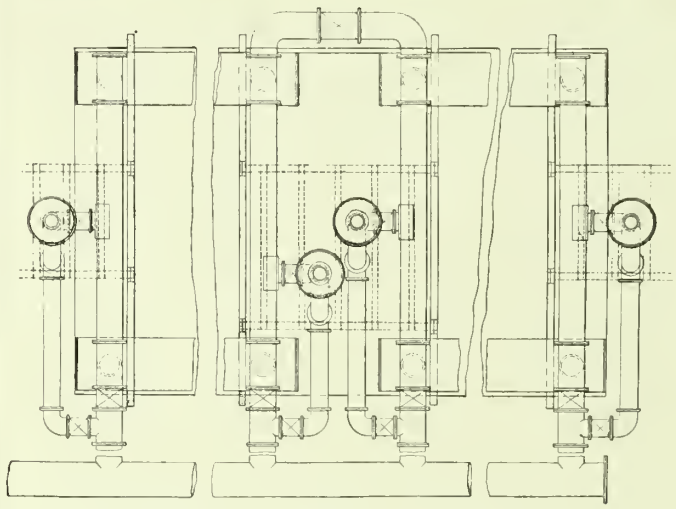
No doubt one of the factors which induces to this economy is the complete combustion of the gaseous fuel used and the utilization of the heat from the products of combustion before leaving the setting. To utilize this to the full, ample chimney area must be at command; otherwise the necessary vacuum can only be attained by raising the chimney temperature so as to lessen the density of the chimney atmosphere, thereby increasing the motive column. Sometimes structural alterations in the settings of retorts can be carried out to lessen that area, which dissipates and robs the gases of their calorific value. In this respect I have found considerable advantage by forming a flat roof above the top settings of the retorts with 12-inch and 4½-inch by 3-inch bricks placed over the 7-inch divisional spaces which extend from the front to the back of the retort-setting, so as to prevent the radiation of heat through the arch of the setting, and also the cutting effect that is sometimes experienced. Since this was adopted, the soffit of the arch is as good as when erected, and the bench is comparatively cool.

To determine the loss of heat dissipated through the crown of the arch and the top of the bench, one must try to calculate the amount of fuel required to maintain this part of the setting to the state of heat sometimes sufficient to fuse the brickwork of the arch, which may be taken, to a large extent, as a direct loss. In our case, the best proof of the economies effected is to be found from the amount of saleable coke and breeze, which averaged for the past two years 11·8 cwt. per ton of coal carbonized over and above that used for heating the retorts.

I have no desire to place before you further particulars as to the latest, and what may be considered the best, form of retort construction, as so many forms are now before you. I prefer leaving this question to the individual opinions of those who are best qualified to judge of what is most advantageous to their varied requirements.



Side Elevation of the Retort-House Governors at the Dundee Gas-Works.

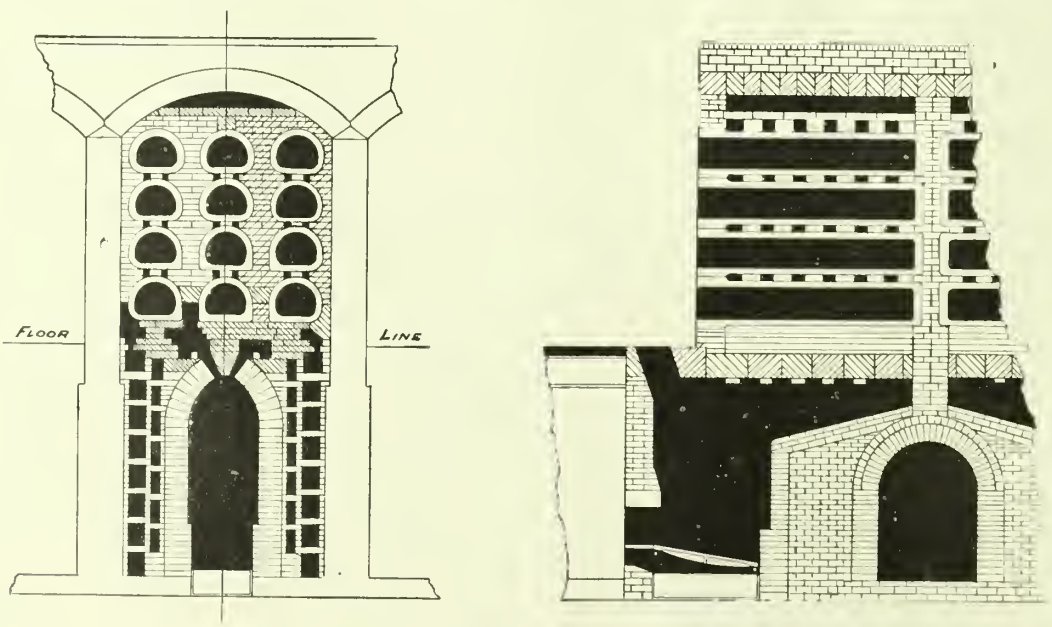


Plan of the Retort-House Governors at the Dundee Gas-Works.

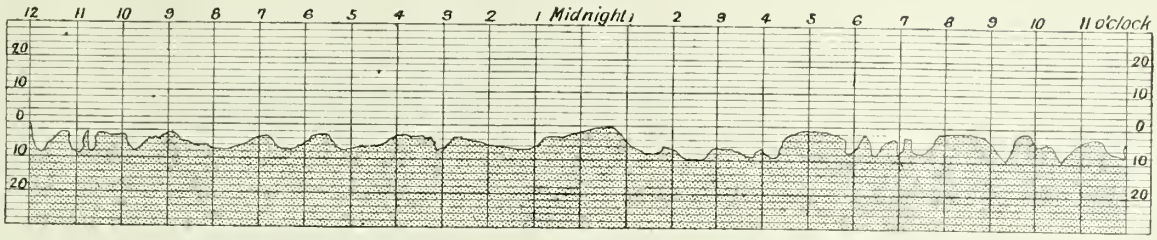
Retort-house governors are now looked upon as essential to the better regulation of the necessary vacuum on the hydraulic main. We have just installed four 12-inch governors, but have not as yet obtained sufficient data to place any reliable figures before you as to the economical advantages to be derived from their use. I hope, however, that by next year the Association will benefit from the experience of someone who has installed similar apparatus at his works, and feels anxious to impart the economies derivable therefrom to his contemporaries.

I may state, however, that the more one studies this question, the more he is convinced of the necessity of having some governing arrangement to lessen the pulsation which oft times takes place in the hydraulic main, due either to the gas from the retorts passing through too great a seal or depth of liquor, or to the vagaries of the exhauster. Now, before one can lessen this seal of liquor, one must have a guarantee of continuity, otherwise difficulties or trouble will be experienced.

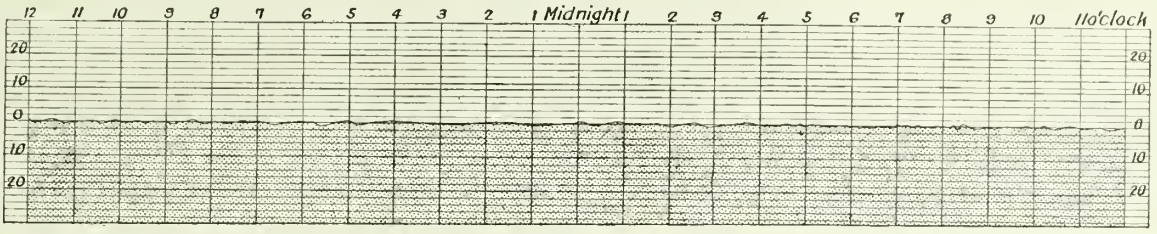
Some may be of opinion that the displacement of the seal in the



Vertical and Longitudinal Sections of the Retort-Settings at the Dundee Gas-Works.

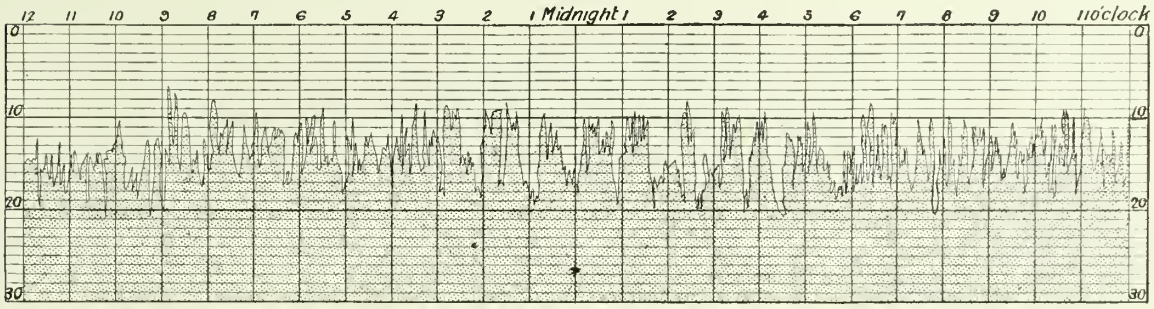


Before Governors were Fitted.

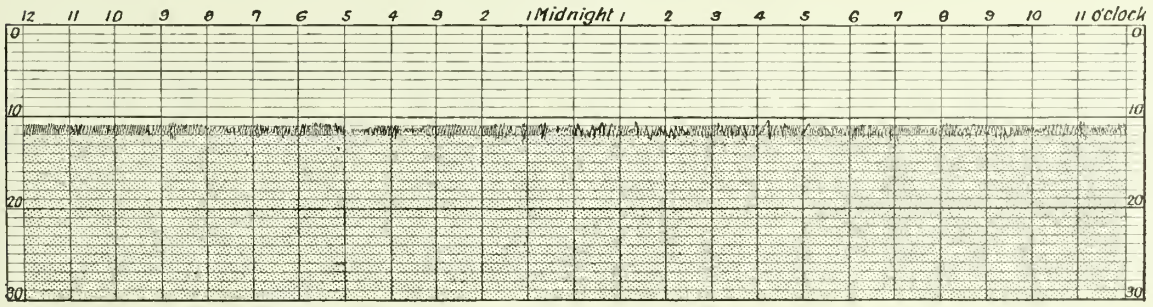


After Governors were Fitted.

Register Diagrams at Hydraulic Mains—Dundee Gas-Works.



Before Regulators were Fitted.



After Regulators were Fitted.

Register Diagrams at Exhauster Inlet—Dundee Gas-Works.

hydraulic may be overcome by increasing the vacuum on the exhauster inlet. This will certainly lessen the pressure on the retort; but it cannot prevent the baneful effects of the hydrocarbon gases passing through the same depth of liquor seal. Supposing we take the dip-pipe with a seal of (say) 1½ inches (to prevent any pulsations in the hydraulic main), and the exhauster working at level gauges, as taken at the hydraulic, and without allowing any extra pressure due to friction, the pressure of the evolving gases will be such as to displace the 1½-inch column of liquor inside the dip-pipe, which also requires to pass through 1½ inches of liquor after having escaped from the pipe.

Supposing we allow the exhauster to exert a vacuum on the hydraulic of (say) 1½ inches, equal to the depth of seal—which, I may state, in passing, is inadvisable, owing to the fluctuation of the liquor level inside the hydraulic—the gas has still to pass through 1½ inches of liquor, which, to some extent, destroys both the volume and the illuminating power of the resultant gases. Now, supposing we were guaranteed that the fluctuations of the liquor in the hydraulic would be reduced to a minimum, we could then reduce the seal of the dip-pipes to (say) 2-10ths of an inch, and the vacuum to a level gauge. The resistance of the gases would then be confined to that due to the passage through the 2-10ths instead of the 15-10ths as formerly.

Nothing that we know of will give these results, except a governor of a size suited to individual requirements. It is imperative that the governor should be placed as near the hydraulic main as possible. As previously noted, I have had four governors fixed; but at the time of writing I have not been able to obtain reliable data to place before you, owing to the short time they have been at work. I may mention, however, that from tests made in our experimental works on an average of three different coals, with a seal of 10-10ths on the dip-pipe and a back-pressure of 5¾ inches with no exhauster, 10,709 cubic feet of gas were obtained, with an illuminating power of 13·82 candles, or 507 lbs. of sperm per ton of coal. With the seal removed, and precautions taken with suitable valves, and with a back-pressure of 1½ inches, the same coal gave 11,182 cubic feet and 14·21 candles with 544 lbs. of sperm value; showing a gain of 473 cubic feet and 0·39 candle.

Regarding the treatment of the gas after it leaves the retort-house, I am conscious that some do not pay the required attention to the regulation of the temperature. At the same time, I must admit that the structural form of the condensers at their command is not the best suited to attain this object. Some may be said to date their creation to a primary age, some to an æsthetic age, and some to what may be termed a utilitarian age. I refer more particularly to the ordinary pipe condenser, the annular condenser, and the water-tube condenser.

In the designing of the ordinary pipe condenser, I have always had them fitted with a cleaning-rod the full length of the box, with an arm about 12 feet long at right angles to the horizontal length, so as to clean either side of the division-plates, and also to clear off any deposit in the bottom of the box; the rod working through a packed gland at one end of the box, fitted on the outside of the rising overflow-pipe, and a suitable size of stopcock to drain off from the bottom level any deposits requiring to be removed from time to time. It is advisable to have the connections so constructed that the inlet and outlet may be made reversible; and if the box is fitted with steam-pipes, no difficulties need be experienced at any time with stoppages or obstructions. To meet the varying makes of gas and the extremes of temperature, they may be constructed in batteries for use as occasion may require.

The annular form of condensers may have their votaries; but, from a practical point of view, the difficulties experienced by variations of temperature detract somewhat from their usefulness. Undoubtedly the best form for the effective regulation of

	Year ending April 30, 1904.		Year ending April 30, 1906.			
	Coal Gas Made, 697,900,000 Cubic Feet.		Coal Gas Made, 653,610,800 Cubic Feet.		Carburetted Water Gas Made, 62,341,000 Cubic Feet. Total Gas Made, 715,951,800 Cubic Feet.	
	Amount.	Pence per 1000 Cub. Ft. Gas Made.	Amount.	Pence per 1000 Cub. Ft Gas Made	Amount.	Pence per 1000 Cub. Ft. Gas Made.
Coal	£39,551 16 5	13·60	£35,330 9 3	12·99	..	..
Benzol	2,768 12 4	0·95	2,253 2 8	0·83	..	..
Gas oil	..	..	..	..	£2335 1 4	8·99
Coke	..	..	..	..	496 7 6	1·91
Breeze	..	..	..	..	74 3 11	0·28
	£42,320 8 9	14·55	£37,583 11 11	13·82	£2905 12 9	11·18
Less residuals—						
Coke and breeze	£8,402 18 8	2·89	£10,969 11 11	4·03	..	..
Sulphate of ammonia	7,603 11 1	2·62	8,497 5 0	3·12	..	..
Coal tar	5,088 6 2	1·75	2,906 14 2	1·07	..	..
Carburetted water-gas tar	..	..	..	..	£211 10 11	0·81
	£21,094 15 11	7·26	£22,373 11 1	8·22	£211 10 11	0·81
Net (less residuals)—	£21,225 12 10	7·29	£15,210 0 10	5·60	£2694 1 10	10·37
Purification (including material and labour)	2,298 14 7	0·79	1,779 3 5	0·66	197 8 3	0·76
Management and office charges	1,093 19 6	0·37	1,016 12 11	0·37	97 0 9	0·37
Wages, carbonizing	7,149 8 7	2·46	5,347 6 10	1·96	..	..
,, boilers and machinery	460 0 0	0·16	629 13 0	0·23	249 10 7	0·96
Repairs, labour and materials	3,605 16 0	1·24	2,549 12 0	0·94	83 18 11	0·32
Water	709 12 9	0·24	730 17 7	0·27	15 0 6	0·06
	£36,532 14 3	12·55	£27,263 6 7	10·03	£3337 0 10	12·84
Net cost	£36,532 14 3	12·55	£30,600 7 5	10 25	..	..

temperature is that known as the water-tube condenser. It also offers advantages where conservation of space has to be considered. In any form of condenser, I think it advisable to have the inlet and outlet made reversible; for the extra expense involved is more than compensated by the other advantages obtained.

I do not consider any works sufficiently well equipped unless they have ample exhausting plant at their command. I have often seen such plant installed which has been quite inadequate to that actually required, to say nothing of the prospective demands it may be called upon to meet from time to time.

One can imagine the depreciation on both engine and exhauster when they are required to work at a speed of (say) 250 revolutions per minute, and also the peace of mind of the party in charge when viewing his labours to overcome the necessary vacuum at a maximum period, with no duplicate to fall back upon in the event of a breakdown. I am afraid his dreams would be somewhat unpleasant, and his sleep wanting in that continuity which alone gives refreshing repose. Anyone contemplating the installation of retort-house governors will not derive the full benefit of their working unless he has ample power in his exhauster plant to create a greater vacuum than that formerly required.

It is now considered imperative that the regulation of the speed of the exhauster should receive more attention than that which is often given. This may appeal to anyone taking a diagram of the fluctuations of the vacuum on the exhauster inlet by the ordinary form of governing arrangements during 24 hours. From my own experience, I have found it impossible to obtain a minimum of fluctuation to within 3-10ths of an inch with the ordinary form of bye-pass governor installed. This can only be attained by stopping off the governor, and controlling the speed of the exhauster engine by a sensitive form of steam governor controlled only by the varying makes of gas. I have also found it advantageous to have the pipe to the governor taken from the hydraulic main, or as near to it as possible, of ample size, and so arranged that it may be cleared as occasion requires.

I have no desire to convert this paper into a presidential address by going through the whole gamut of gas manufacture, as time will not permit; but possibly some notes on the manufacture of carburetted water gas will be acceptable. In the initiatory stages, my experience did not differ from that of those who introduced the system, as several little difficulties of a technical nature presented themselves from time to time, which were soon got over. The plant was installed in October, 1904, and was erected by Messrs. Humphreys and Glasgow. It comprises two sets, each capable of producing 750,000 cubic feet of gas. The installation is fitted with two sets of De Laval turbines connected to Sturtevant blowers; the ordinary working speed of the former being 20,000 revolutions per minute, with 2000 revolutions on the blowers, the latter being reduced to one-tenth the speed of the turbines. At this speed on the blowers we are able to maintain a blast pressure equal to 20 inches in the water column.

No one who has not had experience of carburetted water-gas plant can realize with what ease, convenience, and confidence a manager is able to face his maximum period or a spell of fog or dull weather with such appliances at his command. He rather courts such contingencies from a knowledge that they bring in their train increased business.

It has often been remarked by some that they can make coal gas cheaper than carburetted water gas. This I do not deny; but, in making the comparison, allowance must be made for the higher illuminating value. Allow me to say that with an installation of carburetted water gas worked during the peak-load—say, from October to the beginning of March—the cost of the mixed gases will be less than if no carburetted water gas was made during the period named.

The above is a table of the cost for the year 1903-4, when no carburetted water gas was made, together with corresponding figures for the year 1905-6, when the carburetted water-gas plant was at work.

It will be observed that the net cost for the former period was 12·55d. per 1000 cubic feet, compared with 10·25d. for the year 1905-6. Against the difference in price must be placed the savings effected in the lessened cost for repairs on the retorts, the saving in carbonizing wages, and the larger quantity of coke saleable per ton of coal carbonized, due to all the retorts under fire being constantly at work, as noted below :—

	1903-4.		1905-6.	
	Amount.	Cost per 1000 Cub. Ft.	Amount.	Cost per 1000 Cub. Ft.
		d.		d.
Repairs on retorts	£3605	1·24	£2549	0·94
Carbonizing wages	7149	2·46	5347	1·96
		3·70		2·90
Coke and breeze realized per ton of coal for sale	9·25 cwt.	..	11·86 cwt.	..

In considering the table of costs for 1905-6, no credit can be claimed for lessened costs of material or wages, as they were lower during the former period. This requires to be borne in mind when making the comparison.

I do not consider this paper would be complete unless reference was made to a difficulty that is demanding the consideration of gas managers at the present time—viz., naphthalene. In the past, when cannel coals were more plentiful in Scotland, and were used to a greater extent than they are now, we only knew of this bugbear from the difficulties experienced by our contemporaries in England and in places where coking coals of a like class were used. The spirit of evolution has of late been active in the gas profession, caused by the changing condition of things, which has necessitated a larger use of coking coals in manufacture. The resultant gases naturally contain less solvent properties for naphthalene (which is present in all grades of gas) than that made from cannel coal. It may be taken as an axiom that the lower the illuminating power the less will be the vapour tension of the gas; consequently the gas loses its property of preventing the precipitation of the naphthalene.

Various remedies have been devised to meet this difficulty, such as—

(*a*) Modifications of plant, and the manipulation of same as regards temperatures.

(*b*) Spraying of the gas with hydrocarbon oil as it leaves the works, so that the naphthalene may be washed or precipitated out.

(*c*) Withdrawal or absorption of a portion of the naphthalene from the gas, so that at the lowest temperature the vapour tension will be such as to retain all the naphthalene that remains.

(*d*) Precipitation of the naphthalene in the gas in a liquid form by adding the vapours of a hydrocarbon having the same vapour tension as naphthalene so that when the hydrocarbon vapour condenses out, so will the naphthalene.

(*e*) Elimination of naphthalene by its absorption in creosote or other suitable oil, which also absorbs other hydrocarbons, and lessens the illuminating power of the gas. This may be prevented to a great extent by the addition of 6 per cent. or thereby of benzol.

From all the investigations and experiments I have made on the subject, I am convinced that the proper method for dealing with this difficulty is the elimination of the naphthalene by absorption in a suitable hydrocarbon oil; due care being taken to prevent the loss of other hydrocarbons, as noted under the last paragraph (*e*). With this object in view, I installed a Livescy washer of a size suitable for our requirements.

I purposed going more fully into this question; but, after having learned that a paper will be placed before you to-day dealing with the matter, I advisedly refrained. I have no doubt, however, that sufficient data will be given to provoke a good discussion, which I trust will be to the advantage of all.

Discussion.

Mr. J. Napier Myers (Saltcoats) rose, not to discuss the paper, but rather to thank Mr. Yuill, as he had interrupted him several times during the reading of it, for having come forward at very short notice. He begged to thank him also for the information he had given them.

Mr. J. W. Napier (Alloa) said they recognized in Mr. Yuill, not only an expert engineer, but also an expert financier—indeed, looking to the history of Mr. Yuill's connection with the gas industry, they were inclined to think that the finance department had been rather the most important part of his success. Regarding the retort-house governor which he had fixed, and which he (Mr. Napier) regarded as a thoroughly good thing, he might mention what was the amount of exhaust at the inlet to the exhauster, and also the difference of exhaust between the inlet of the governor and the outlet of the governor. This point was required, because he stated in another part of the paper that anyone contemplating an installation of these governors would need a sufficiently large exhauster. He mentioned the difference in cost between water gas and coal gas; and, referring to the tables for the year 1906, it was found that the amount received for residuals was quite 1d. more than in the previous year. This arose, perhaps, from the lessened cost per 1000 cubic feet of a mixture of coal and water gas. Then the lessened cost between the production of water gas *plus* coal gas, and coal gas alone, was simply owing to the collateral advantages they had heard of—viz., being able to keep retorts going steadily; there being less coke consumption; less wear and tear; less wages; and other charges being correspondingly affected.

Mr. P. B. Watson (Wishaw) asked if they could be informed as to the cost of introducing the governors.

Mr. W. Prince (Stoke-on-Trent) wished to be allowed to compliment Mr. Yuill on his paper, and to bear out, in every detail, what he had said about the excellencies of retort-house governors. He had had about eighteen months' experience with them; and he strongly recommended every brother manager to adopt some such form of doing away with that great "wish-wash" from the exhauster which was often found a considerable distance in the foul main and the hydraulic main. It was a matter they had to consider, sooner or later, if they wanted to maintain their dividends in these days of high rates for coal. Without doubt, at a cost of about £30, any man could increase his make of gas by something like 1000 cubic feet per ton of coal, and that with the greatest ease—with no attention, and with no trouble. He noticed Mr. Yuill had adopted the enclosed form of governor, as made by Messrs. Bruce Peebles and Co., who seemed to have got a step in front of others in this matter. His governor was shielded from the dust and dirt which collected in a retort-house. It was fixed on the top of the bench, between the two foul mains; and he had no trouble whatever in the working.

Mr. J. Napier Myers asked Mr. Yuill, in regard to the action of the governor, whether he had long enough experience of it to notice any effect it might have on the deposition of carbon inside the retorts. He himself had had long enough experience in making gas to realize the disadvantage of the deposition of carbon in retorts; and he had long held the opinion that the back-pressure, and the wishy-washy action of the exhauster, caused a shaking of the gas within the retort, and a certain amount of attrition of the gas. He had thought this was responsible, in some way, for the deposition of carbon. If the action of the governors would effect a steady and constant pull upon the gas, he would anticipate that it would likely militate against the deposition of carbon.

Mr. W. B. M'Lusky (Perth) asked if Mr. Smith, of Stirling, could give them any information regarding the results secured by his brother at Hawick.

Mr. J. D. Smith (Stirling) was afraid he could not, further than that, since they put in the governor, they were able to run up to 12,000 cubic feet of gas at the mouthpiece, which they never were able to do before within somewhere about 3000 cubic feet. In his own case, he had put in a retort-house governor, but had not yet started work with it. He, however, anticipated good results from it.

Mr. M'Lusky said he was told the other day that at Hawick they were getting 12,000 cubic feet; and it was very gratifying to have this fact corroborated. Hawick had always been celebrated for big mouthpiece yields per ton. He remembered getting the advice from Mr. Smith, of Hawick, "Draw clean and charge heavy;" and he was convinced that, if every gas manager ascertained that the stokers were drawing the retorts absolutely clean, and charging heavy at the back end, in the orthodox way, they would hear less about the deposit of carbon. They never found carbon where they had coke. They used to hear, in the old days, about the leaving of so much space, for heat waves and the like. The conditions to-day were totally different; and there was no getting away from the fact that the heavier they could get the charge the better, and also the less carbon there would be. This was, of course, away from retort-house governors; but it related to practical working, which was Mr. Yuill's theme. It was also a point, in connection with any new plant, that they had to take into account not only the benefits to be derived from the plant, but the advantages obtained from the attention they gave to it, in their endeavour to see that it gave the return expected. He had no doubt that where retort-house governors were introduced, greater attention would for a time be bestowed upon working. He had everything to say in their favour; but he had no records of any increase in the yield of gas per ton of coal carbonized. It was rather early yet, perhaps, to take tables and minutes in regard to this; but at the present time he had no knowledge of any increase in the yield of gas per ton. Apart altogether from this, however, he was convinced that the retort-house was not right, however small it might be, without a retort-house governor. It was not a question at all of £ *s. d.*, but of efficiency. They simply could not regulate the result without a retort-house governor. The exhausters at Perth were as perfect as it was possible to make exhausting plant; and if any gas-works could run along without a retort-house governor, it was in Perth. The regulators there were so sensitive that on a Sunday morning, when the stokers were putting off retorts, the exhausters actually slowed down themselves and stopped at a dead-centre; and if the exhausters were put to dead-centre on Sunday evening, they would start again, and regulate themselves. But they had the other matter, notwithstanding, of the area; and this was where he would like to retract a former statement. In spite of all the ample area, this area was fixed; but the quantity of gas they made, from hour to hour and minute to minute, was not fixed. It was variable; and if they had plant adjusted to take off a certain yield, they could set their exhauster to do this work, and it would do it, at the exhauster-house. But when they had a large increase of yield at a particular moment, and a correspondingly large accession of pressure or reduction of pull in the condensers, then they had their gauge altering in the retort-house; and this was why the retort-house governor was a success.

Mr. J. Hepworth (Edinburgh), in explanation of one or two points which had arisen, said it might interest them to know that the retort-house governor was introduced more than twenty years ago, and by the firm of which he was now a member. Few people out of London then cared to consider it; but it had been in use, in more than one place away from London, for a long time. The London engineers, he was told, preferred to have it without a cover; and so it was made without a cover to suit them. But for a long time past now, the governor had been made both with or without a cover, as the buyer might determine. With regard to the inquiry about carbon, probably Mr. Yuill would tell them that his experience had not been very extensive—he told them so in his paper—and that he had, therefore, not had time to determine whether or not the use of the retort-house governor induced a large deposit of carbon; but he knew perfectly well what Mr. Yuill's experience would be twelve months hence. There would be no increase in the deposit of carbon; the tendency was in the other direction. Some gentlemen had mentioned that a retort-house governor was sure to increase the make of gas per ton of coal. If a man, however, was getting 12,000 cubic feet per ton, he did not see that he could have much of an increase; but everybody was not making that. What he would like to say, further, was that a retort-house governor gave them absolute freedom from anxiety as to illuminating power. They could go to bed knowing that, whatever might happen in the retort-house, their gas would not be interfered with, because the governor would take care of it. There were other matters in connection with it, as to which this, of course, was not the time to speak, but upon which everybody interested in it would take opportunity of informing himself, as time went on. He (Mr. Hepworth) had been extremely interested in what he had heard that day.

Mr. Yuill said he felt honoured by the intelligent way in which the members had criticized his paper, because he always felt that there was nothing like a good criticism to draw out the facts; and it made the matter much better understood sometimes to the audience than if there had been no discussion. Mr. Napier Myers raised the question as to the pressure at the inlet to the exhauster, and at the inlet to the governor and on the hydraulic main. With reference to the exhauster, with the old form, before he

started the governor, he generally worked with 15-10ths, so as to give a slight pull on the hydraulic main to overcome the seal he had, which was about 1 inch. But since he started the governors, he had had to increase the pull; and he found they worked much better with double the exhaust he had before—that was, 30-10ths on the exhauster. In his paper, he mentioned, in speaking of exhausters, that they would require to bear in mind, if they contemplated putting in governors, that they must see that the exhausters were capable of doing their work, because they would never do their work with an exhaust of only 2-10ths to work the governors. They must always have an excess of pull, so as to make the governors more sensitive. The 30-10ths was reduced to about 25-10ths at the governors—the difference being caused by the friction in passing through the length of pipe, and in the hydraulic main itself. The gauge in the hydraulic main stood at level; and it was maintained at this during the whole twenty-four hours. If there were any variation, it did not exceed 1-10th; and he could corroborate Mr. Hepworth that they could go to bed and feel sure that it would not have altered before the morning came. Undoubtedly a light seal did give them a saving in the hydrocarbons. He thought they understood the point that, with the governor, they were able to keep the seal at such a low level as they never could have risked before with the fluctuation on the exhaust. Mr. Myers also went into the question of the savings in the carburetted water gas. Those who had had experience with carburetted water gas would understand where these savings came in. There was a saving in wages and in coke. The difference was 0·8d. per 1000 feet. This, taken over a whole year, with him, would come to about £2400. Mr. Watson asked as to the cost of the governors. Considering the years they would be in use, their cost would form no criterion. He was very pleased to have Mr. Prince's corroboration of his experience with the governors. He had no fear that anyone who had had experience with retort-house governors, would not have the same sort of feeling as he had, which was—"I wish that I had known of this earlier." With reference to the deposition of carbon, he thought they now understood the principles which governed the action of the gas in the hydraulic main; and they would understand that if they lessened the pressure of gas on the retort, and also lessened the pulsation of the gas, they were doing all they possibly could to lessen the deposition of carbon. He had not as yet had such a lengthened experience as to enable him to determine as to this; but he thought that, if they considered the circumstances under which he now worked, as compared with what he previously did, they were all in favour of lessening the deposition of carbon. Mr. M'Lusky had had these governors erected; and while he had nothing to say on the subject, he, as he always did, had given them very valuable information. The fact was that Mr. M'Lusky could give them more valuable information than he (Mr. Yuill) could, because he had had them longer at work; but still, he thought, Mr. M'Lusky had corroborated what he had said.

INTRODUCING GAS TO A NEW DISTRICT.

By James Campbell, of Polmont.

[A Paper read before the North British Association of Gas Managers, July 25.]

It seems a very hopeful sign for the gas industry when we occasionally read in our Technical Journals of the erection of works for the supply of gas to new districts, as, while most of these districts are undoubtedly small, this only serves to show that gas is still a necessity, and that the many advantages of a gas supply are now being realized to a greater extent, and by even the smallest communities. In the writer's experience with such a new district, it was instructive to hear the views expressed by many residents as to the desirability or otherwise of having a gas supply. Many of them wondered how any company would venture to start a gas-works at this time of day, as, according to them, electricity was now the correct thing and the only medium for up-to-date lighting. Some feared that with our price (4s. 2d. per 1000 cubic feet) only a certain class could afford to use gas, and that its employment would accordingly be limited.

It was quite evident that the "take-it-or-want-it" attitude of gas companies of former days had made a certain impression, even on a district where there was no gas supply; and there was also a certain amount of scepticism regarding our statements as to what could be done by means of gas. Hence our first duty lay in dispelling the prevailing ignorance as to the capabilities of gas, and in showing practically what could be done by incandescent lighting.

When the works were nearing completion, a circular was issued stating when the Company would be ready to supply gas, and also giving the conditions under which a supply could be had. It is very necessary in the case of a new district to give special inducements to probable consumers, as in many instances the cost of installing gas would be sufficient to prevent the securing of a customer. It was found that the cost of the service-pipe would prove a hindrance, as a water supply had been recently introduced. These services had to be paid for by consumers all the way from the water-main to the house; and there was an impression that the same conditions would apply to gas. It was therefore decided to lay service-pipes free up to 25 feet beyond the line of the street; pipes beyond this distance being laid by the Company and charged to the consumer at cost price. A special point was made of this in the circular. The extra capital cost thus caused was comparatively small, and the concession proved of great advantage. The other conditions in our circular were: Ordinary and prepayment meters, with stopcocks, supplied and fixed free; no meter rents; gas company undertake internal fittings work, and supply backets, burners, &c., at lowest rates; cookers fixed free and hired at low rentals. It was pointed out that, under these conditions, most houses would have their service-pipes laid and meter supplied and fixed free; and then some information was given as to the cost of gas lighting. The result of a liberal distribution of this circular was the receipt of one application for a gas supply.

The area supplied, which comprises four distinct villages, has necessitated the laying of fully 6 miles of mains, crossing on the way seven railway and canal bridges. Part of the district is mining villages; but most of it contains cottages of a good class and owned by those residing in them. Doubtless it may be asked why high-pressure mains were not put down in such a district. This was fully considered before the mains were laid, but it was ultimately decided to lay two 6-inch pipes from the works, each of them supplying two villages. Though the villages are distinct, we have customers all the way; but none of these had any use for a supply at high-pressure direct from the main. Immediately we had made a quantity of gas, and before it was turned on to the mains, we fitted up a Humphrey lamp outside our retort-house, as a light placed there could be seen from a considerable stretch of roadway. This proved a splendid advertisement, and was quite a revelation to most people as to what could be done by incandescent lighting. Then about this time we were fortunate in securing the contract for the street lighting of one of the villages in our district; and 26 lamps, all with incandescent burners, were erected and gave great satisfaction. This, in conjunction with the lighting at the works, brought prominently before the public the superiority of gas lighting.

Orders now began to come in more freely; and it was quite evident that our advertisements were the houses we fitted up and the light that was supplied. People visiting houses where there was a good incandescent burner could hardly fail to be struck with the difference between the light thus given and that emitted by an oil-lamp. This led to inquiries being made as to cost of gas lighting and the cost of introducing gas into a house. When an inquiry was received, the writer visited the inquirer personally; and the method of dealing with a probable customer was this: All information was given as to cost of lighting. It was pointed out (if the house was within our free supply distance) that the supply was brought into the house and the meter fixed without any charge. Then the house was measured and the quotation given, which included everything except brackets, burners, and glass. The prospective customer was then invited to our show-room at the works to make a selection from our stock of brackets, &c., there; and the price of these, added to the estimate given, enabled the customer to know exactly what the work would cost. If a customer could not conveniently come to our show-room, then either a selection of brackets was sent to his residence, or along with our offer approximate prices were given for suitable brackets. It has been to our advantage to deal thus with customers in letting them know exactly what their house fittings would cost, and so preventing any misunderstanding, as they came to know they could rely on the statements made, and a feeling of confidence was established both with regard to fitting work and gas supply.

Our station-meter house was fitted up as a show-room. This has been of great service to consumers, as we have always a good stock of fittings, and several brackets and pendants connected to the gas supply enable us to show brackets, burners, and glassware to advantage. We have also cookers, fires, &c., connected up, so that practically every requirement in an ordinary household may be exhibited. Even the smallest gas companies can profit by having a show-room. This need not necessarily be open continually. In our case, the writer asked prospective customers to advise him when they would call, so that he could meet them personally. But, in any case, with the show-room at the works, there is always someone about who can show the stock.

No definite rule as to profit from fittings can well be laid down in the case of a gas company doing gas-fitting business, as each application must be considered on its merits. In the Polmont district, cases have arisen where only a limited amount of money could be spent on fittings; and then the Company did the utmost for that sum—doing the work, if need be, at cost and being repaid by the gas consumption thus gained. In most instances, however, a moderate profit can be made on the work, and the consumer still have the fitting done at considerably lower rates than are charged by plumbers. Our men fitted up well over 200 houses and shops last winter.

There is a great advantage in introducing a gas supply to a district where none of the houses are fitted for gas, and where the gas company can manage, as we did, to fit up fully 95 per cent. of the houses where gas was introduced. Ample pipes are laid on, provision is made for a cooker or fires being subsequently required later, and only approved incandescent burners and mantles are employed; the result being that we have wonderful freedom from complaints—a proof, if any were needed, that it is seldom the gas is really to blame, but more often the fittings,

when there is cause for complaint. An instance came under the writer's notice recently in his district, where a plumber fitted up a workshop with five flat-flame burners. The pipe leading from the meter was a ¼-inch iron one; the result being "bad gas." In some cases where consumers wished to employ their own tradesmen to do the gas-fitting, the writer prepared specifications for the work, and advised as to the placing of the lights. That this has been successful is evidenced by the fact that practically every new consumer now comes to the gas-works for information regarding the gas-fitting of his premises. With new premises it has been of advantage to see the proprietor and arrange for pipes of sufficient size were laid, and provision made for probable cooking and heating appliances.

No inconsiderable trouble was caused by mantle breakages when first the supply was turned on, as the consumers had not been accustomed to handling such articles. Some even declared that it cost them nearly as much for mantles as it formerly cost them for oil. When, however, one could point to the street-lamps—where, by the way, the mantle consumption was only two per lamp from October to May, as we had a specially good wind-proof lantern—and show mantles that had been in use for quite a long time, this helped to convince them that the cause of the breakages could easily be traced to the handling of the bracket. In such cases, a mantle given free and properly fixed goes a long way in satisfying new consumers. Then, again, there was some trouble through consumers shutting off the air supply to burners "in case the gas would escape." But, of course, such complaints as these were easily remedied. Still, they serve to show some of the difficulties with consumers who have had no previous experience with gas.

As the result of experience in such a district as ours, with new mains, ample interior fittings, and good incandescent burners, we find that we require to give a pressure of about 25-10ths at the consumers' premises to ensure satisfaction; and over the greater part of last winter we did not reduce our pressure in the day time. One reason for maintaining such a pressure during the day was that, when burners were fitted and the gas supply adjusted during the day time, they were unsatisfactory in the evening—necessitating their being attended to during lighting hours. It is interesting to note that a large percentage of the incandescent burners used are of the inverted type, and they have generally been very satisfactory.

When first surveying meters, the writer found that many consumers were disappointed with the cost of their lighting, though all were highly pleased with the light. But he made a point of telling them what their cost was per day and per week. This almost invariably was an agreeable surprise, and led to consumers recognizing that, after all, incandescent gas lighting was as economical as oil, and certainly more convenient. He also cleaned burners, fitted on mantles, advised as to the use of cookers and such like, and by this means kept in touch with consumers' requirements. This constitutes an advantage for the manager of a small works over those in charge of large ones, as, by these visits, he knows nearly every consumer personally; and the personal element is of considerable value. It was found that a large number of consumers had been using their cookers improperly—such as placing pastry, &c., on top of the browning shelf, and, consequently, having the food burned on the bottom and uncooked on top; but having been shown the correct method, there was satisfaction afterwards.

There is no doubt that it would be to the advantage of gas companies generally to employ trained lady lecturers to visit consumers' houses and show them the proper and most economical methods of using a gas-cooker, as though its use is thoroughly explained at an exhibition, consumers fail to carry with them many small details that make for successful working. It is of interest to note that as incandescent lighting came to be generally used, the requirements in lighting were immediately raised—people who were formerly satisfied with the light of an oil-lamp being dissatisfied unless their incandescent gas-burner was at its best. Then, again, consumers had cookers fixed, and before many days elapsed found them to be indispensable, although some of them had never seen a gas-cooker before.

To make our services indispensable has been our aim; and this, coupled with the assurance that we have made no exaggerated claims for gas, has resulted in our getting, and keeping, a goodly number of customers. Our works were only started last October. Since that time we have connected up 250 consumers, and fixed over 100 cookers and grillers and 4 gas-engines; and still the demand shows no falling off. Such mains as were laid before the gas was turned on were tested by means of air at a pressure of about 2 lbs. per square inch. Suitable plugs were placed in the ends so that the air would be easily expelled when the gas was turned on; and after the first two or three days no further trouble was experienced with air in the pipes. It was noticed, however, that for a very considerable time the gas had a faint and not unpleasant smell—in fact, it is only now, after ten months' working, coming to have a real "smell of gas." There was also for the first few weeks an apparently heavy leakage; but this steadily diminished. These facts, taken together, seem to point to some absorption occurring—presumably either the iron pipes or the coating material being the cause. Before the mains were laid, we generally asked prospective customers whether they would require a supply; but very seldom could we get sufficient encouragement to induce us to lay a pipe in particular places. However, in spite of this, mains were put down; and in all cases this has been justified, as invariably, after the pipe was laid, we secured people as customers who previously would not commit themselves to take a supply.

In conclusion, some instances may be given as showing that the methods adopted have been successful, more especially with regard to competition from the electric light. A large firm, at the head of which was expert chemical and mechanical knowledge, and where working costs were taken out very closely, formerly made oil gas and generated electricity for the lighting of their works. After going thoroughly into the matter, they decided on taking a supply of gas from our mains, both for lighting and for manufacturing purposes. Another firm, generating electricity on their premises for lighting purposes, and regularly using over 100 lights, have now decided to entirely dispense with their electric plant and instal incandescent gas lighting; and this mainly as a result of seeing the lighting of other premises and comparing it with their own. In a workshop where a 25 B.H.P. oil-engine was working, we managed to have it replaced by a gas-engine (the gas for which is supplied at 3s. 4d. per 1000 feet); and now, after several months' working, the owners are perfectly satisfied. Such facts as these are our best advertisements.

Discussion.

The PRESIDENT remarked that the subject of the paper was one which appealed strongly to many of the members; and there was a great deal of interesting matter in it.

Mr. A. WADDELL (Dunfermline) said that Mr. Campbell was one of their newest members; and this was, therefore, his first paper. He considered he had made a very good commencement indeed; and he hoped they had in him a man who was capable, from time to time, of giving them an interesting paper. Mr. Campbell had had the total erection—all the engineering and the management—of the works he was now serving in. He had, therefore, had a very unique experience. He had erected the works; he had opened up all the books of the business, and kept them; and he had had to deal with all the points he had brought before them that day, of how to put the gas before consumers. Mr. Campbell had succeeded even beyond anything that he anticipated when he began. He believed that he had more than satisfied his consumers also, even with gas at a comparatively high price; and he had been able to supplant one or two oil-engines, and get a pretty large customer in that way. He had also been able to supplant electric lighting in a co-operative store, where they had been generating electricity for themselves. Altogether, he had met with very considerable success in the opening up of the new works at Polmont.

Mr. D. ROBERTSON (Dunoon) congratulated the author. It was not very often that a young man came forward and read a paper giving experiences such as Mr. Campbell had had at Polmont. It was a very interesting experience for a man to go into a new works—quite different from going into a works where half-a-dozen men had been working before him. There was one very interesting point Mr. Campbell had mentioned, that was the great apparent leakage which took place at the beginning of the supply. Of course, this was because the pipes absorbed gas before they were thoroughly saturated. There was another point—the peculiar smell the gas had. This he considered was due to the coating of the pipes becoming dissolved and being carried forward with the gas. He thought the success of the undertaking was very much owing to Mr. Campbell.

Mr. A. REID (Brechin) had enjoyed Mr. Campbell's paper very much. It occurred to him once or twice that it was papers like this which the vast majority of their members required. In Scotland there were very few of them who could hope to get into large works, because not many large ones existed. The Association was mostly made up of men in small works. A paper like Mr. Campbell's was, therefore, very helpful to them, because most of the members had to come into daily contact with their customers. The paper showed them how to meet their consumers, and let them see the proper way to use the product they were getting from them; and it was one which, he was certain, they would all profit by. In regard to the competition Mr. Campbell had had, and his being able to supplant electric lighting in one or two instances, some of them were very glad to hear this. He (Mr. Reid) was standing between two gentlemen from towns which, like his own, were supplied with electricity by one electric corporation. He referred to Montrose and Inverness. Either of them could give the meeting his views in regard to that corporation. He read a paper two years ago on the competition they had; and he was glad to say that they were now in a much stronger position than they were then. It was not so much electricity they had to fear as oil.

Mr. J. M'FARLANE (Maybole) thought that Mr. Reid had said everything which could be said on behalf of young men. He himself did not go into a new district by any means. He went, some years ago, into a town where, for some remarkable reason, gas was looked upon as being too antiquated for anyone to use, and far too dear at 4s. 7d. per 1000 cubic feet. One of the things they did was to shorten the quarters, thereby making the accounts smaller; and this helped considerably. Three months before he went to Maybole, there were 470 consumers; now there were 820. There were three factories using electric light. They were there before he went; and he had been told by the proprietors that if they had to do it again, they would not have the electric light. Their pride, however, more than anything else, was at stake; and he could not get them to climb down. But the electricians were

at another factory, which he had fitted with incandescent burners. The cashier in this factory was really too sharp for them. He asked them if they could light the place better than it was; and the electricians then saw that they had a man to deal with who knew what he was talking about. They said "no." The cashier then asked if they could do it cheaper; and they again said "no," and the cashier told them he would not have their light. They had incandescent burners in every church in the place, in all the street-lamps, and in almost every house; and there was certainly not 20 per cent. of their consumers who had not cooking appliances of some sort. All these things had had the effect of enabling them to reduce the price of the gas, which, after all, was the best means of increasing the consumption.

Mr. A. Wilson (Glasgow) characterized Mr. Campbell's paper as a modest record of good work well done. The lines the author had gone on were, he thought, equally applicable to large as to small undertakings. The personal element came very much into play in both cases. Any amount of circularizing, issuing of pamphlets, and the like, bore not the slightest comparison to a good man going round telling an unvarnished tale regarding the excellent results to be obtained from gas efficiently used. There were troubles they were apt to get into, sometimes, by sending a man round who did not know his business. Such a man often did more harm to the gas business than they thought of. They should give instructions to their men, where they did not go themselves, that they should just promise what they could actually perform—rather under than over, because they could always give good value to the public for what they charged. The record Mr. Campbell had given was unique in its way. He did not think he ever saw, in the proceedings of any of their Associations, an account of the starting of a gas-works, and of the management of customers, such as Mr. Campbell had laid before them. The author was to be congratulated, not only on the paper he had given them, but also on the way he had carried on the works; and he was sure that if Mr. Campbell went on in the way he was doing, he would have a large increase of his business before very long.

Mr. Campbell, in reply, said he was very pleased at the reception that his paper had had; and he thanked the speakers for the remarks they had made.

REGISTER OF PATENTS.

Indicating Mechanism for Test Gas-Meters.

Milne, J., and O'Connor, H., of Edinburgh.

No. 14,649; June 27, 1906.

In their specification the patentees say: It has been found useful to ndicate on test gas-meters the cost of the gas passed through in a given period; and to enable this to be done with the gas at different prices per 1000 cubic feet, it was proposed, in patent No. 6233 of 1896, to indicate it by means of mounted step-wheels into which change-wheels of various diameters could be geared so as to suit certain varying prices of gas consumed. In the present invention, however, without the use of step-wheels, a change-wheel in the train of wheels connecting from the crank of a dry meter, or from the spindle of a wet meter drum to the spindle of the pointer, is employed to show the cost; so that, by varying this change-wheel according to the price of the gas, the cost indicated for a given quantity will directly follow the price per 1000 cubic feet. The change-wheel to be used has either a crown-wheel gearing into a pinion, or a wheel having the periphery upon which the teeth are cut of sufficient breadth to enable the teeth of the crown-wheels of the required different diameters to engage, or ordinary toothed change-wheels could be used, the axle of which could be moved and fixed in such a position as to enable wheels of the required different diameters to engage with the wheels of the train.

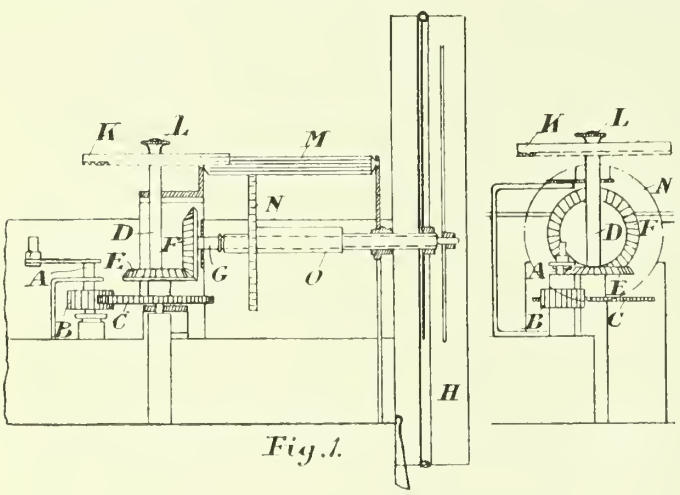


Fig. 1.

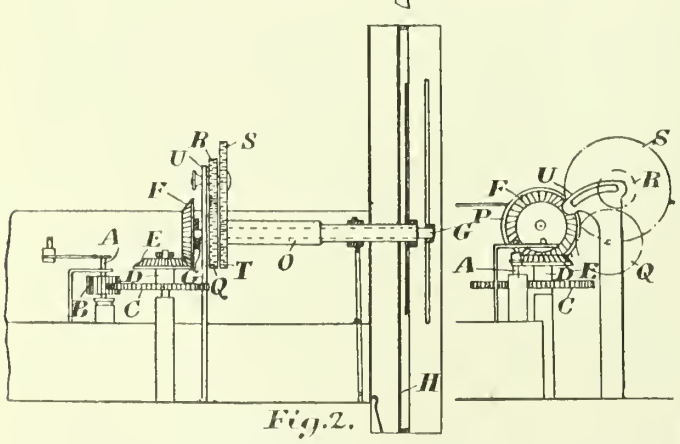


Fig. 2.

Milne and O'Connor's Test Gas-Meters.

Fig. 1 shows the invention as applied to a dry meter. A is the crank-spinole to be actuated by the passage of the gas through the meter. Upon this a wheel B is fixed gearing into another wheel C, fastened upon a spindle D which carries a bevel-wheel E gearing into another bevel-wheel F at right angles. The axle G is carried right through to the front of the dial H, and has upon it a pointer indicating the quantity of gas passed. Fastened to the spindle D at its upper end is a crown-wheel K, fastened by means of a thumb-screw or nut L. This crown-wheel gears into a pinion M, which, in its turn, gears into a wheel N on an outer spindle O, through which passes the spindle D. On the spindle O is another pointer, indicating on the dial H by another circle of figures the cost of the consumption shown by the pointer on the axle G. The greater the number of teeth in the crown-wheel K, the quicker will the pinion M revolve, and with it the wheel N, spindle O, and its pointer; so that the price indicated will be greater the larger this crown-wheel. The pinion M being placed radially to the centre of the wheel K serves for any diameter of wheel within the limits of the length of the pinion M, so that a change can be immediately made as required. It is preferred to make the gearing so that each tooth upon the crown-wheel represents 1d. per 1000 cubic feet; so that a thirty-tooth wheel is used when the price of gas is 2s. 6d.

Where the mechanism is to be used with a wet meter, the wheel B is fastened to the upright spindle driven by the passage of the gas through the drum of the meter—the mechanism otherwise being as above described.

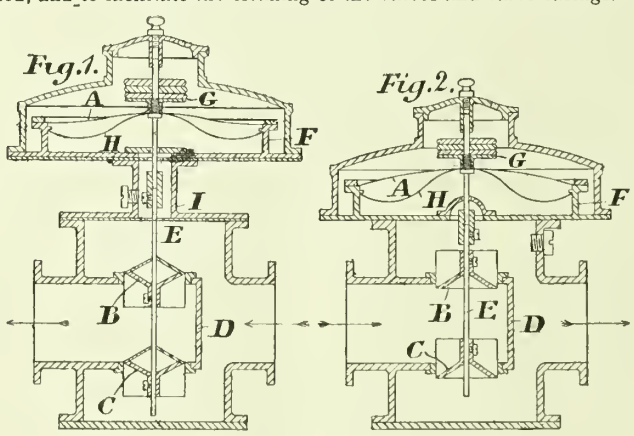
In fig. 2, an alternative system is shown where ordinary toothed change-wheels are used. On the back of the bevel-wheel F is fixed an ordinary toothed wheel P gearing into another wheel Q; this again gearing into another wheel R, the axle of which is arranged so that it can move in a circle at a constant distance from the centre of the wheel Q, so that the wheel R is always in gear with the wheel Q. The axle can be moved nearer to, or farther from, the wheel P, so that the change-wheel S, which is fixed upon the axle of the wheel R, may be brought into gear with the wheel T on the outer shaft O carrying the second pointer, as described for fig. 1. A lug is fastened to the axle of the wheels R and S so that it can be clamped with a quadrant U by a thumb-screw in the desired position.

Governors.

Thorp, T., of Whitefield, Lancs.

No. 22,134; Oct. 8, 1906.

This gas-governor is designed with the object of maintaining a more uniform pressure than with the diaphragm form of governors hitherto used, and to facilitate the cleaning of the valves and valve casings.



Thorp's Foul-Main and Station Governors.

Fig. 1 represents a foul-main governor, and fig. 2 a station and main governor.

The pressure regulating device of the governor consists of an equilibrium valve (connected to a weighted flexible diaphragm A) formed of two conical discs B and C of the same diameter, and guided by means of wings in rings fixed in the top and bottom of the internal chamber D of the valve casing, which is arranged, as usual, with branch pipes leading respectively to the internal chamber between the valves and to the external casing, and communicating with the space above and below the valves. The valve discs are fixed separately on the spindle E by set-screws so as to adjust their distance from one another; and the spindle is detachably connected to the diaphragm A, so that, after it is disconnected, it can be drawn out with the valves through the bottom of the casing to be cleaned without disturbing the diaphragm.

The diaphragm is fixed to the flanged open top of a short cylinder F, by a clamping ring and bolts (not shown); and the spindle is connected to it by means of clamp washers. The spindle carries a tray G for the weights used for loading the diaphragm to suit the desired pressure. Over or under the diaphragm a blade spring H, as described in patent No. 5791 of 1905, is arranged to assist the weights in pulling the diaphragm downwards. The pull of the spring H decreases as the

diaphragm A rises, and thus counteracts the increase of downward pressure resulting from the stretch of the diaphragm. Thus the latter rises and falls with a very small difference of pressure. The spring may also be arranged to press the diaphragm upwards with an increasing pressure as it rises, which will have the same effect. The diaphragm is preferably made of several plies of proofed canvas or of oxidized oil sheeting.

In the case of station or main governors for cold gas, the bottom of the cylinder F can form the cover of the valve casing, as represented in fig. 2; while for foul-main governors, regulating the flow of the hot gases from the retorts to the exhauster, a separate cover having a central pipe I with a flange on top for fixing the cylinder bottom is preferred, as represented in fig. 1. Asbestos washers prevent conduction of heat from the valve casing to the cylinder F. The gas contained in it therefore, after it has once cooled down, will remain cool, as no further appreciable quantities of hot gas will enter it—thus protecting the diaphragm A against the effect of the heat.

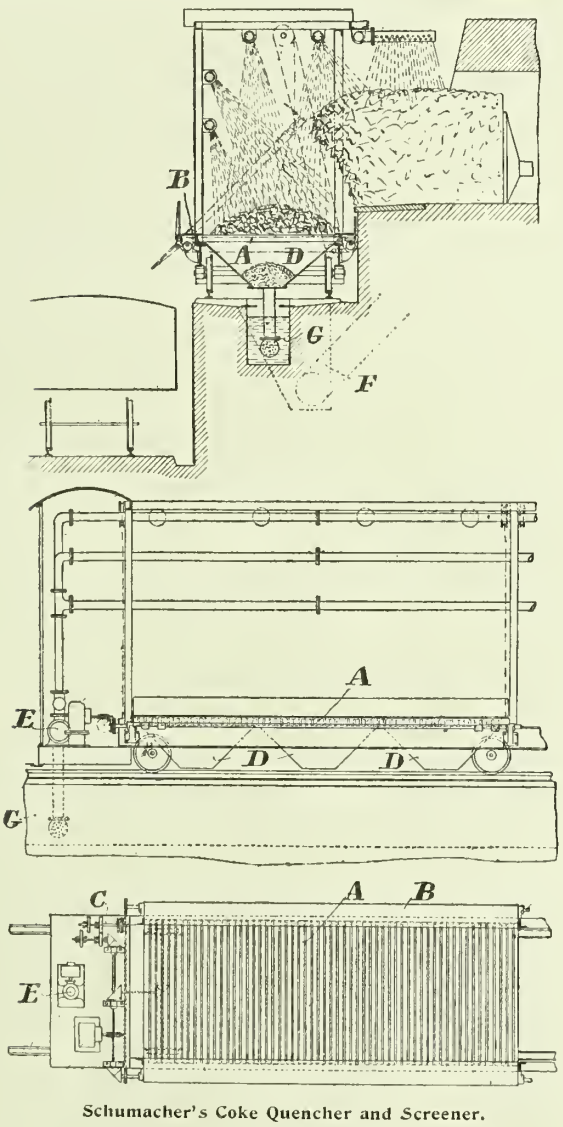
The branch pipe of the casing leading to the space above and below the valves B C, and communicating with the diaphragm cylinder F, is connected to the part of the main in which the pressure is to be kept constant. Thus in station and main governors (fig. 2), the outlet is connected to the delivery mains and the gas admitted through the inlet branch between the valves, which are so set that they open downwards and become closed when the diaphragm rises as the pressure in the delivery main increases. In foul-main governors (fig. 1), the inlet is connected to the foul main and the outlet to the exhauster—the valves being so set as to open upwards and close when the pressure in the foul main decreases; the valve spindle E being prolonged downwards, so as to come against the cover when the valves are fully closed and preventing their being opened downwards. By this means "the pressure in the main and the retorts is kept normally constant, and the danger of air being drawn into the main when the exhauster races is prevented."

Quenching, Screening, and Conveying Coke.

SCHUMACHER, W., of Düsseldorf, Germany.

No. 14,964; Jan. 30, 1906.

This invention relates to apparatus for quenching, screening, and conveying coked coal from ovens or retorts.



Schumacher's Coke Quencher and Screener.

The arrangement adapted to coke-ovens is as follows: In front of, and lower than, the ovens on the quenching side is a track on which the screening and conveying apparatus is arranged. This apparatus is provided with a motor which actuates one spring-shaft and two laterally arranged shafts by means of wheel gear. On the conveying apparatus, at the bottom, is a grating A constructed with movable bars, one half of which can be raised and lowered, while the other bars remain stationary. This raising and lowering are effected by the shafts already referred to, eccentrics on which engage directly below the bars which are to be raised; but those which are not raised are connected by frames like the frames B, so as to be raised or lowered by the eccentrics which always execute the same movement on both shafts. For the raising, ropes or chains are employed which wind on drums of a shaft C that can be actuated either by hand or motor. Below the track, hoppers D are arranged to be opened and shut by slides or the like. The device is provided with a pump E in communication with a suction pipe and with pressure pipes, on the latter of which nozzle pipes are arranged. The suction pipe dips into a channel open above, and runs between the travelling rails; and when the device is moved, it always remains in communication with the water. At one or both ends of the track, or at some other place, are pits F, which can be furnished with elevators or the like.

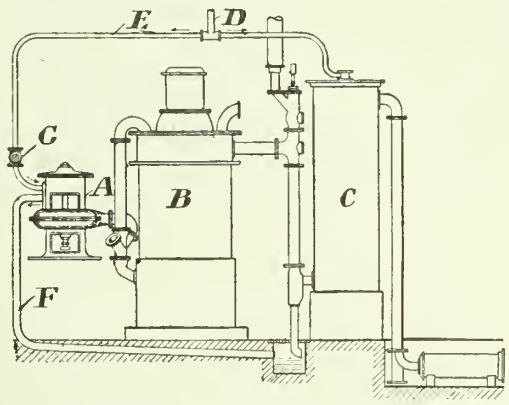
The action is as follows: When the grating is in a horizontal or in a slightly inclined position, the charge of one of the ovens is pushed on to it; and during the discharging of the coke from the oven, the pump, and thereby the spray pipes, are operated. During the discharge and the quenching, the movable grating bars are raised and lowered, whereby the material lying on them is set in motion, and the small coke falls through the bars into the hoppers D, whence it may be conveyed into the pit F for further treatment. The water necessary for the quenching is pumped out of the channel through the suction pipe and conveyed to the water-conduit; and all water that is not evaporated flows through the perforated sides of the hoppers D back to the channel G, where it filters down and is again used.

Suction-Gas Plant.

KÜNZLER, A., and SCHNEIDER, F., of Konstanz, Germany.

No. 7405; March 27, 1907.

The starting of suction-gas producers has hitherto been effected, the patentees remark, by clearing the generator and fanning or blowing the fire until gas flowing from a test or pilot burner burns with a flame of a certain colour. Then the connection to the scrubber is made; the chimney valve closed; the generators filled to the rim of the feed hopper; and the latter closed. Thereupon the producer is started. Only in the case of very large engines (of over 200 H.P.), where electric current is usually available, the fan or blower is actuated by an electro-motor for blowing the fire, which usually requires half-an-hour or more. In the case of smaller engines, hand fans or blowers are almost exclusively used, so that two men are required for starting the producer—one to operate the hand fan or blower, while the other performs the other operations required. The present invention relates to means by which the starting can be effected by one man in cases where electric current or an electro-motor is not available.



Kunzler and Schneider's Suction-Gas Plant.

As shown, there is provided, instead of a hand fan or blower, a hydraulically operated fan A—a type of plant which can always be used with advantage instead of blast apparatus not mechanically operated, provided that water at a pressure of approximately three atmospheres is available. In all suction-gas plant water under pressure is used for wetting the coke in the scrubber C, so that a water-pipe E, leading to the blower but normally closed by a cock G, can be connected to the supply pipe D.

APPLICATIONS FOR LETTERS PATENT.

16,658.—DARRAH, H. M., and MARTIN, J., "Gas-fittings." July 20.
16,737.—BUSH, A. W., "Taps or valves." July 22.
16,768.—WOOLLEY, A., "Gas-producers." July 22.
16,785.—BROWN, BOVERI, & CIE. AKT.-GES., "Jet-condenser plants." July 22.
16,820.—HANNAN, J., "Application of gas for the generation of power." July 23.
16,855.—DAWES, T. J., "Locks for manholes of mains." July 23.
16,862.—HARE, A., "Automatically operating gas or other valves at predetermined times." July 23.
16,867.—SÜSSMAN, H., "Incandescent mantles." July 23.
16,890.—MONSEUR, A., "Gas-furnaces and the like." July 23.
16,937.—BOULT, A. J., "Gas-generators." A communication from Akt.-Ges. Gorlitzer Maschinenbau Anstalt u. Eisengiesserei. July 24.
17,020.—JONES, T., "Gas for power purposes." July 25.
17,044.—COHN, S., "Mantles." July 25.
17,113.—KIKUT, E., "Gas-engines." July 26.
17,153.—BROWNE, A. F., "Discharging continuously working vertical retorts." July 26.
17,154.—BLANC, E. E. P. M., and CATON, P. A., "Manufacture of illuminating gas." July 26.
17,174.—BOULT, A. J., "Charging gas-retorts." A communication from the Compagnie pour the Fabrication des Compteurs et Materiel d'Usines à Gaz. July 26.
17,176.—BENNETT, G. S., "Steam-blast gas-burners." July 26.
17,252.—JAUBERT, G. F., "Gas-generators." July 27.

THE GASLIGHT AND COKE COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Friday, at the Chief Office, Horseferry Road, Westminster—Mr. Corbet Woodall (the Governor) in the chair.

The Secretary (Mr. H. Rayner) read the notice convening the meeting; and the seal of the Company having been affixed to the register of proprietors, the report and accounts (which were given in the "Journal" last week) were taken as read.

The Report and Accounts.

The Governor: Ladies and gentlemen, before moving the adoption of the report and accounts, I have a few observations to make upon them, and upon the position of the Company. You will doubtless agree with me that the report shows the Company to be in a prosperous condition; the accounts proving that the advances and economies in manufacture to which reference has been made at recent meetings are fully maintained. The capital account, due partly to the operation of the redemption fund, is less in amount now than it was at the end of last year, and the charge for dividend and interest per 1000 cubic feet of gas sold is appreciably reduced. The actual expenditure for capital purposes amounted in the half year to £54,317; and the credits in respect of depreciation of plant, meters, and stoves, to £53,444. The increase in the latter item is explained as follows: When in 1894 the Company started fitting up small houses with automatic meters for the benefit of the poorer class of consumers, it was arranged, with the sanction of the Government Auditor, that the cost of pipes and fittings inside the houses should be charged to a suspense account rather than to capital. Now, however, as was explained to you at the last half-yearly meeting, this suspense account has been completely liquidated. It has been decided by the Directors to show in the revenue account the amount received through the extra charge made to the automatic meter consumers for the use of fittings; and you will now see on the credit side this amount entered for the first time as "Rental of fittings, £58,545." This is after the deduction of a small proportion which is treated as stove-rental, and is included under that heading in the same account. On the other side, the charge on account of fitting up additional automatic meter supplies will be found entered under the item "Gas-fittings, including labour (automatic meter supplies), £29,258 2s. 10d." With regard to the balance, a scheme for the depreciation of automatic meters and stoves during the next few years has been submitted to, and passed by, the Government Auditor, which will appropriate the difference between the income for fittings and the expenditure for new installations. The amount carried to depreciation under this scheme for the past half year is £27,589 8s. 11d. The most satisfactory feature of the revenue account for the half year is the increase of 3¼ per cent. in the gas sales. In the half year to June, 1906, the gain was nearly 4 per cent.; so that as compared with 1905 the increase is upwards of 7 per cent.—a rate of progress which, considering the size of the Company, must be taken as distinctly encouraging. Practically no expenditure of capital on manufacturing plant has been necessary to produce this larger quantity of gas. The increase in gas sales yielded an additional revenue of nearly £40,000. The rental of stoves was greater by £2130 than in the corresponding period of 1906; while there was a large increase in the revenue obtained from coke, amounting to nearly £60,000. The working expenses of the half year may also be regarded as satisfactory. Coal and oil cost the Company nearly £58,000 more than previously; but, apart from the greater quantity of gas made, this was balanced by the better return for coke. It is gratifying to note that, notwithstanding the increased business done by the Company during the period under review, manufacturing wages were less by £20,000, and purification by £12,000. The item of "Repair and maintenance of plant" has gone up by £12,000. This is not a matter for regret; it simply shows that we have persisted in the policy, which has already yielded excellent results, of maintaining works and plant in a high state of efficiency—renewing whatever is obsolete and uneconomical. The expenditure for distribution shows an increase on meter and stove repairs. This, however, is due, as I explained when dealing with the capital account, to special writing off for depreciation. Had it not been for this, the meter repairs would have been £27,400—showing a slight reduction below 1906. The increase in actual stove repairs is due to a large reduction of the stock of stoves waiting repair. They are now dealt with more rapidly as they come in, so saving expenditure on capital account. The item "Gas-fittings" is the one which I have already explained—viz., the fittings in automatic meter consumers' houses. There are two other items in the accounts which call for special note. The first is the reduction of over £7000 in rates and taxes, due to our now feeling the full effect of the reduction in rateable value which was obtained at the last quinquennial re-valuation; and the second is the large amount (£11,700) carried to the insurance fund. This is made up of a special contribution of £2500, and the writing down of Consols, in which this fund is invested, to £85 per cent. Hitherto the Company have not written down this stock, and it has stood in our books at the sum paid for it. The nominal amount will now more nearly represent the realizable value of the investment. There has been handed to me this morning a note from a shareholder, asking me to explain how the reserve fund is invested. The reserve fund, which we have not depreciated, is invested in 3 per cent. India stock. The actual cost was £63,000; and the present market value is under 86—coming to £54,500. The depreciation is therefore about £8000. It appears to us that this stock is not unlikely to improve in value; and therefore it was not necessary to deal with that amount at present. The net result of the half-year's working is that, after providing for the fixed charges and setting aside £10,000 towards the redemption fund, there is a profit of £411,206 6s. 6d. Adding to this the amount brought forward from the previous half year—namely, £229,952 19s. 11d.—the total available for dividend is £641,159 6s. 5d. Out of this sum the Directors recommend a dividend at the rate of £4 8s. per cent. per annum on the ordinary stock; and after paying £150 on account of gas-testing forfeitures, £306,992 6s. 10d. is left to be carried forward to the credit of the current half year.

Technical Instruction for the Staff.

The scheme of scientific and technical instruction for the staff of the Chief Inspector's Department has been actively carried on; and the first examination was held in April in this room. There were 56 Assistant-Inspectors who presented themselves for examination in the first class of candidates; and 99 clerks, foremen, fitters, and others, entering in a second division. The result of the examination was very valuable, both directly and indirectly. It has served as an additional guide to the selection of deserving members of the staff for promotion and distinction; confirming the good repute of some, and bringing forward others whose merits might otherwise have been longer in gaining recognition. During the summer, the staff instruction has been extended in the most practical shape to the mechanics—gas-fitters and their assistants—of the department. There is every reason to believe that this further development is appreciated by, and is benefiting, the men, who in this work are constantly required to deal with the needs of consumers and with new inventions in gas apparatus.

The Company's Prospects—The Coal Industry.

We are better able to form a judgment now than we were six months ago as to the prospect before the Company in the near future. Our contracts for coal and oil for the year to July next are completed, and involve, as you have been told in the report, an extra expenditure of £250,000 for the same tonnage. This is a heavy tax, and delays for the present our hope of reducing the price of gas. It is, however, matter for congratulation that there will be no necessity to increase the price, and that our income in the coming year will probably meet our expenditure. The condition of the coal industry is remarkable. Not only does the reserve unsold appear to be very small, but there is great difficulty in getting deliveries from some fields over the railways and through the ports. Some of the latter are crowded with ships waiting a turn to load; many of the freights being for foreign parts. The enormous increase in the exported quantity since the removal of the coal duty is doubtless responsible in large part, if not wholly, for the fact that the demand has overtaken the power of supply. No one wishes to see the coal trade injured; but it cannot be for the good of the country that home industries should be crippled, as is now the case, where a profitable remedy is within reach. It is impossible to say how long the high prices will continue. My own opinion, founded on past experience, is that the period will be but short. In the meantime, it is gratifying to know that, however costly the coal-fire may be in the coming winter, those who use gas, whether for light or fire, for stove or for motor, will experience no change.

Meeting the Increased Cost of Coal.

The Directors naturally gave careful consideration to the question how the heavy increase in the cost of coal was to be met. We were already pledged not to raise the price of gas except in face of absolute necessity; while to curtail expenditure on maintenance was directly contrary to our policy. One other plan was available. You will probably have noticed that, following upon negotiations with the London County Council, the Directors have decided to resume the charge for meter-rents, which was discontinued in 1894. It is not necessary to inquire into the reasons which led to the surrender of these rents. There can be no doubt that the change on the part of the Gaslight and Coke Company alone was a blunder. I called attention eighteen months ago to the disadvantage under which the Company were placed before the public when their charge for gas, which included meter-rent, was compared with that of their neighbours, which was supplemented by meter-rents, and expressed my opinion that the inequality should be rectified. This, then, was a suitable opportunity to right a blunder, and to obtain the needed additional revenue. Meter-rents would yield about £60,000; and this would see us through the year of famine price. Not only does the change help us financially and rectify the charge for the purpose of comparison, but it brings under contribution the great number of meters to which I formerly referred as earning no interest because they were retained, most of them, merely as a security against possible failure of electric lighting. Interest upon these meters has hitherto been a charge on the gas, and borne by consumers generally.

The Re-imposition of Meter-rents.

When we were before Parliament in 1903, the question of meter-rents was considered at the instance of the London County Council; and while declining to surrender our right to make the charge so long as it was retained and exercised by the other Metropolitan and Suburban Gas Companies, we stated that it was not our intention to re-impose them. In view of this expressed intention, the Directors felt bound, in courtesy, to take no action without the concurrence of the London County Council. The proposal we made was, first, that if the rents were recharged the Company would apply no portion of the revenue so derived to the increase of dividend; and, secondly, that there should be no increase in the price of gas for one year. These suggestions, so transparently fair, were accepted by the Council, who recognize that we have not departed from the honourable understanding of 1903. A few members seemed to fear that, as they expressed it, there was something behind our proposals—that they were so favourable to the consumer that we must have some hidden motive in making them. I wish it were possible to convince these gentlemen that we have been perfectly open and ingenuous in our statements that the desire and aim of the Company coincides with its interest, and is to supply gas at as cheap a rate as possible; and that, under the arrangements made with the Council, the whole of the revenue we are to derive will be devoted to that purpose.

Smokeless Fuel.

During the last six months, much has been heard about smokeless fuel. Should a demand arise in London for such fuel for household purposes in place of coal, the Company, I am glad to say, are in a position to supply it; in fact, we are already doing so.

FORBEARANCE OF SHAREHOLDERS AND ZEAL OF THE STAFF.

In conclusion, I can without reserve congratulate you and the proprietors generally upon the state and prospects of the undertaking. Thanks partly to your forbearance in not pressing for the full dividend to which, under the sliding-scale, you were entitled, in still greater degree to the able and unstinted service of the chief officers and staff, and, further, to the circumstances which I have detailed, we are able to face what would otherwise have been a time of great trial with a perfectly easy mind. Having regard to the depression and anxiety which just now attend so many industrial undertakings, this is matter for special thankfulness. I beg leave to move—"That this meeting do agree with and confirm the report of the Directors and the Auditors' report and statement of the accounts of the Company, as transmitted to the proprietors on the 25th ult."

The DEPUTY-GOVERNOR (Mr. Howard Charles Ward) seconded the motion, and congratulated the shareholders generally upon receiving what was clearly one of the best accounts that had been presented to them for many years past.

The GOVERNOR invited comments on the part of shareholders, and said he would reply to any questions that might be asked.

REMARKS BY A SHAREHOLDER.

Mr. C. E. JONES said the report and statement of accounts, as well as the Governor's eloquent exposition of them, was a fair commentary upon what had been called a "declining industry." Even now, in some over-sanguine temperaments, there was a disposition to consider the gas interest moribund; or, at all events, every person took up the position that it was a losing one. He could thus congratulate the proprietors very much indeed upon having such a satisfactory report. It showed the elasticity of the business, and the growing popularity of gas, whether used as a fuel or for lighting, or other purposes for which it was so admirably adapted. Gas was still gaining in favour, notwithstanding the competition of many rivals. That was a matter of considerable congratulation. That there was some form of smokeless fuel needed, was evident; and if there was a demand for it, gas companies could easily produce it. By stopping-off the process of destructive distillation earlier than was customary, they might obtain what was practically "Coalite;" and he would suggest that a strong effort should be made to cultivate such a trade. The smoke nuisance was something that was very injurious to health, and was occupying the attention of scientific minds; and everything that went to remove the smoke cloud from the London streets would be a blessing to mankind. With regard to the material advantage which had been derived from the sale of coke, he wished he was sanguine enough to hope that the advantage would be a permanent one. The Governor had very justly condemned some of the conditions of the coal market; but he (Mr. Jones) could not agree with the idea that it would ever return to its former figure. What with Government supervision and the influence of labour over the coal masters, he did not at all anticipate that there would be any reduction in the price of coal for a considerable time to come. There was just one point which was conspicuous by its absence from the report, and that was the Workmen's Compensation Fund; and as there was such an absorbing interest just now centred in the probable operation of the Act, he thought it would be some consolation to the shareholders to know how the Board were dealing with this very serious question. The operations of the Act must be very onerous and expensive, and the statutory obligation now imposed upon gas companies in particular, and industrial interests in general, was perfectly alarming. Where it was going to end, one did not know. His own feeling in the matter was that the measure was hostile to trade and contrary to the genius of commercial people. It was revolutionary, inasmuch as it interfered with the free right of contract; and it was repugnant to home and social life. The Act was inimical to the interests of the working classes, for whose benefit it was supposed to have been promoted. It was sad to think what would happen to those people who were not physically strong, or whose mental condition and hours of labour would remove them from the Act. They could not contract-out of it; and the result would be that there would be a large diminution of employment in the country where there was too much unemployed labour already. He was satisfied that if this piece of legislation remained, it would not do what its promoters thought it would. It would not promote thrift; but it would encourage carelessness, and promote discontent and fraud.

The GOVERNOR: If no one has any further question to ask, I will answer what has been said by Mr. Jones. But before doing so, I may say that a note has just been handed to me asking for an explanation of the different prices charged for gas—viz., 2s. 2d., 2s. 11d., and 3s. The ordinary price charged is 2s. 11d., subject to certain discounts to large consumers and when used for power. The price of 2s. 2d. is charged on the south of the Thames, and follows automatically the price charged by the South Metropolitan Gas Company, with an addition of 2d. because we are under an obligation to supply 16-candle gas, as against 14-candle gas on the other side of the Thames, The South Metropolitan Company now increase their price to 2s. 3d.; and consequently this Company's price on the south side of the Thames will be 2s. 5d. I am not quite sure about the 3s.—the shareholder has probably included the amount charged for repairs, maintenance, lighting and cleaning of the public lamps. That would bring it up to 3s. With regard to Mr. Jones's interesting observations, the Company are, as you are aware, already doing a great deal towards the abolition of the smoke nuisance. I do not claim the merit for the Gaslight and Coke Company alone, but for all gas companies who encourage the use of gas-fires, as you do not have much smoke from chimneys where gas-fires are used. If a demand does arise for smokeless fuel, I repeat, as I said in my opening remarks, that we are in a position to supply it, and are, in fact, already doing so. You will be able to see it burning downstairs if you choose; and we shall probably take means in the winter time to introduce it very largely. With regard to the Workmen's Compensation Act, we do not share quite the dreadful fears of Mr. Jones with reference to its operation. The expenditure under the Act during the last half year has been £1322; and when I remind you, as I did on the last occasion, that we already spend in pensions and allowances to our officers and workpeople more than £48,000 a year, the amount is not a very serious addition to our past expenditure. This, I think, covers all the points that have been raised, and I will now put the resolution.

The resolution was carried unanimously.

THE DIVIDEND.

The GOVERNOR then proposed that the following dividends be declared: On the ordinary stock, £4 8s. per cent. per annum; on the convertible 5 per cent. preference stock, 5 per cent.; on the 4 per cent. consolidated preference stock, 4 per cent.; and on the 3½ per cent. maximum stock, 3½ per cent.—all payable on Sept. 2.

Mr. HOWARD C. WARD seconded the resolution, which was put and carried unanimously.

The GOVERNOR: That will complete the ordinary business of the meeting.

VOTES OF THANKS.

Mr. J. REESON proposed a hearty vote of thanks to the Governor for his lucid and interesting address, and was sure his brother shareholders would join in expressing the opinion that the prosperity of the Company was mainly due to the energy displayed by Mr. Woodall. He also desired to express his appreciation of the able conduct of the other members of the Board.

Mr. W. A. SURRIDGE seconded the resolution, and remarked that the report presented that day was the best testimony of the able services rendered by the Board.

The resolution was passed unanimously.

Mr. A. H. BAILEY proposed a vote of thanks to the officers and staff for the excellent services they had rendered during the past half year. There could but be one opinion about the report, he said, and that was that it was the best which had ever been presented.

The GOVERNOR: On behalf of my colleagues and myself, I thank you for the vote you have just passed. We are proud and thankful that the Company are able to present so excellent a report as we have been able to put before you to-day. I had proposed for myself the pleasure of moving a vote of thanks to the staff. As I am anticipated, I ask to be allowed to second it. I have already said how much we feel we owe to the chief officers and staff, and, I may say generally, to the whole body of men who work for us. There has been nothing but the most cordial, hearty, and able work on their part through now a long period; and it is with the utmost satisfaction that I acknowledge their constant readiness to do anything and everything that is either pointed out to them or that occurs to them to enhance the prosperity of the Company.

The resolution was unanimously carried.

Mr. D. MILNE WATSON (the General Manager): I should just like to express in one word the thanks of myself and of the staff for the high appreciation you have expressed of our efforts. We naturally are very proud of the Company to which we belong, and we are very anxious to see it prosper. We have had our bad times, and now I think we are having our good times. The fight is an uphill one; but perhaps that makes it all the more interesting. Where there is no fight, there cannot be much interest in the work. I can say that the sole anxiety of the officers, one and all—both those here and those at work in different parts of the district—is to put the Company in a sound position; and we shall continue to work as hard in the future as we have done in the past. I thank you most heartily for the kind way you have referred to us to-day.

BRENTFORD GAS COMPANY.

Directorial and Official Changes—Coal Market—The Forged Transfers Act.

The Half-Yearly Meeting of this Company was held on Friday, at the Westminster Palace Hotel—Mr. ULICK J. BURKE in the chair.

The SECRETARY (Mr. William Mann) having read the notice calling the meeting, the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN, in moving their adoption, said he should first like to refer to the alteration in the *personnel* of the Board since the shareholders last met. They had had many changes. In the first place, their late Chairman, Mr. Howard C. Ward, to the great regret of his colleagues, felt himself obliged to retire from the chair, and take matters perhaps a little easier. It was hardly necessary, he thought, for him to go into the career of Mr. Ward as Chairman of the Company. He occupied the position for 36 years; and during those years he never missed a general meeting. He therefore presided over 72 general meetings; and he (the Chairman) thought the proprietors would agree with him that the splendid position to-day of the Brentford Gas Company was largely due to the constant supervision of, and interest taken by, Mr. Ward in its affairs during the time that he had occupied the chair. The capital of the Company per ton of coal carbonized was now not more than £4 13s. 9d.; but it was a great deal more than that at the time Mr. Ward became Chairman. Then the proprietors would all have heard of the death of Mr. Frank Morris, who was also in office (as Director, and formerly as Engineer) for a very considerable time; and they all associated much of the advance of the Company with the intelligent engineering of Mr. Morris. To him they were greatly indebted for the introduction of the inclined-retort system. Inclined retorts had been very much identified with the prosperity of the Brentford Company, and the Brentford Company with the advance in use of that system. They believed that the inclined retort as used at Brentford was the proper system of carbonizing. Mr. Morris was very much missed by his colleagues; and it was an important question as to who was to succeed him. It was a great advantage for them to have expert opinion on the Board; and they felt it very desirable, in filling up Mr. Morris's place, that they should be able to have further expert opinion. Mr. William King, of Liverpool, whose name was no doubt familiar to the proprietors as it was known throughout the gas world, and who was formerly particularly familiar to the Directors in connection with the work he did on the Departmental Committee, had been elected to take the place vacated by

Mr. Morris; and the proprietors might be congratulated on the fact that they had a man of such intelligence and experience to aid in the counsels of the Board. There was yet another loss, because their Engineer (Mr. James Husband) had also left them. He retired after the last meeting. Mr. Husband had not, of course, quite done what Mr. Morris did; but he (the Chairman) thought they must remember that they owed a large debt of gratitude to Mr. Husband. He was with the Company about 24 years, and no doubt he did excellent work for them. He was sorry to say Mr. Husband, though comparatively a young man, was afflicted in his domestic affairs, in a way that was extremely trying to him, and it might be that his work somewhat slackened through this. However, he had gone from them. To fill Mr. Husband's place, they came to the conclusion that Mr. Alexander Johnston, who had a good reputation at Ilford, would be the best man they could possibly get. The Ilford Gas Company parted with him with much regret; and the Brentford Directors—not, however, to their regret—availed themselves of his services. So far as they had seen of Mr. Johnston at present, they had no cause to regret their choice. To follow Mr. Ward in the chair, his colleagues were so flattering as to elect him (Mr. Burke). He could only say that the proprietors should have the best he could give them; but if it was not good, then he hoped they would obtain someone else. Turning to the report, it would be seen they had an increase in the sale of gas of 6·70 per cent. This was very satisfactory. The balance of revenue account amounted to £45,201; and with the balance from last account, £53,305, they had, after deducting interest on debenture stock, the sum of £94,539 for dividend. That, in a nutshell, was the position of the Company. They might congratulate themselves on being in this satisfactory condition. In these days, they did not get 6½ per cent. increase in every Company quite so easily as that. They had sharp competitors. The increase in gas, meter, fittings, and stove rental was £11,377. Though the finances of the Company were in such good case, it was needless to say they had a great many calls, and there faced them a great many unknown calls, upon the balance they had in hand. They could not go on having increases such as this without spending money. The policy of the Company had always been to keep down the capital as much as they possibly could; and if this had not been the policy strongly supported by Mr. Ward, the Company would not be in such a comfortable position as now. They did not want to dip into their capital, except to a certain extent, at present. The state of the coal market was an unknown quantity. One man would tell them the price was going down; another that there was no possible chance of such a thing. He had himself heard from a man interested in the coal market that there was no sign of the price declining. The coal that was going to foreign parts, especially to Germany, was something enormous; and there was not likely to be any immediate drop in the quantity exported. Though in a certain measure, the sending of coal to Germany had been due to the troubles of the Westphalian people, it was not so now that they had got over these troubles. And it therefore became a question whether it was not the commercial prosperity of Germany that was demanding the enormous quantity of coal from this country. Therefore, he did not think they would see any immediate reduction in the price of coal. Developments in the gas world had increased their manufacturing possibilities and necessary capacities. There could not be 6½ per cent. increases without studying the question of manufacturing provision. Therefore they had to look round now, and see how far their machinery was equal to the bigger demands made upon it. The Board felt that the Southall station especially would require a good deal of attention. They would want machinery of all sorts, as well as further dock accommodation. They could at present only accommodate five barges, which was very small. The Board also anticipated that it would be necessary to lay a further main between the Brentford and Southall stations. Of this the proprietors might be satisfied, that the Directors did not wish to spend a penny more than was necessary.

Mr. Howard C. Ward seconded the motion. In doing so, he said that he had occupied the chair for 36 years; and while he did not wish to blow his own trumpet, he thought he might fairly claim that the interests of the Company did not suffer during that period. When he became Chairman of the Company, there were a certain number of £50 shares and of £25 shares. These shares to-day were represented respectively by £78 and £39 of consolidated stock, on which a dividend of 12½ per cent. was being paid. The concern was in a thoroughly sound and efficient condition. They had a good insurance fund, a good reserve fund, and a good balance of profit. He (Mr. Ward) had outlived the Directors of the Company three or four times; and he was standing there now nearly 81 years of age. He thought it was really time he left the administration more to younger and more energetic men; and he had the happiness to know that he retired from the chairmanship with thoroughly active and able men around him, full of ability and energy, to carry on the affairs of the Company. In his own career, he always received the greatest kindness and cordial support from the proprietors, and he begged to thank them for it.

Mr. A. B. Bosher congratulated the Board on the appointment of Mr. King as a Director, and of Mr. Johnston to the engineership. With regard to the question of coal, he met two or three South Yorkshire colliery gentlemen at Sheffield recently, and asked them what was their opinion as to the trend of coal affairs. They said that coal was going to remain very much on the lines of what the price was now—at any rate, so far as they could see, up to next June. After next June, anything might happen—either a great fall or a further small rise. It was impossible to say anything more than that.

Mr. J. Reeson also expressed the regret of the proprietors at the retirement of Mr. Ward from the chair.

The motion was unanimously carried.

A dividend was declared at the rate of 5 per cent. per annum on the 5 per cent. preference stock, 12½ per cent. per annum on the consolidated stock, and 9½ per cent. per annum on the new stock, 1881.

The Chairman next moved that the provisions of the Forged Transfers Acts, 1891 and 1892, should be put into operation in connection with the Company.

Mr. R. J. Neville-Neville, in seconding the motion, said this was a matter that was not perhaps very important, because in their Company they were dealing with honest men. But there had been cases in which some companies had been largely and badly hit by the fact that they had had to make good certain stock which had been transferred on a forged transfer. The Directors thought they ought to avail themselves of the advantages given by the Act to enable them to insure themselves against having to pay a large sum in case of a forged transfer. If there was a big transaction, it might be such as to interfere with the dividend; and therefore the Board thought they ought to take advantage of the protection the Act gave them.

A vote of thanks to the Chairman and Directors and officers concluded the proceedings.

SOUTH SUBURBAN GAS COMPANY.

Half-Yearly Report and Accounts.

The following is the report of the Directors for the six months ending the 30th of June, which, with the accounts, will be presented at the half-yearly general meeting on Friday.

Fortunately the coal contracted for in 1906 was sufficient to supply the Company's need during about five-sixths of the half year under review, while throughout the half year a higher price has been obtained for coke than in the corresponding period; and there has been an increase of 3·4 per cent. in the consumption of gas. The profit earned is consequently sufficient to pay a dividend, which the Directors recommend, at the rate of 5½ per cent. (the same as last year); to make an addition to the insurance fund, bringing it up to £20,000; and to slightly increase the amount carried forward.

The Directors with great regret have to inform the shareholders that the serious rise in the price of coal on the contracts made in April has compelled them to increase the price of gas from Midsummer to 2s. 7d. per 1000 cubic feet, as explained in the circular issued to the consumers. The effect of this increase of price under the sliding-scale will be to reduce the dividend payable by 6s. 8d. per cent., or £2016 a year. But as the dividend paid since the last reduction of price has been 3s. 4d. per cent., or £1008 a year, below that to which the shareholders were entitled, the actual reduction of dividend will be 3s. 4d. per cent.; and so long as the price is maintained at 2s. 7d., the dividend payable will be at the rate of £5 6s. 8d. per cent. instead of 5½ per cent. hitherto paid.

Another effect of the increase of price is to reduce the co-partnership bonus of the employees. This bonus increases as the price of gas falls, and decreases when it rises. For the past twelve months they have received a bonus of 6⅓ per cent. on their salaries and wages, or a total of £3075. The sliding-scale principle has been extended to the employees—thus making a triple partnership of consumers, shareholders, and employees, uniting all three interests; it being thus to the advantage of shareholders and employees alike that gas shall be sold at as low a price as possible. The effect of the increase in the price of gas is to reduce the employees' bonus from 6⅓ to 5 per cent., or about £700 a year. It has often been said that so long as the bonus is maintained or increasing the employees will be content, but that a reduction of bonus or a sharing of losses would cause the failure of the system. The price of gas was increased, and the bonus, as well as the dividend, seriously reduced, in 1901; and the employees equally with the shareholders understood the position, and accepted it without a murmur. As soon as possible, the Directors will again reduce the price and increase the dividend to the shareholders and the bonus to the employees.

In other respects the affairs of the Company have been prosperous and uneventful. The works and plant are in thoroughly good order, and capable of efficiently meeting any demands that may be made upon them.

In 1904 the shareholders adopted a scheme for the election by the shareholding workmen of two of their number on the Board. In 1905 a bricklayer and a carpenter were elected as Directors; and your Directors have the great pleasure to state that men more suitable in every way could not have been found. The scheme authorizing the election of Employee Directors expires this year; and if the system is to be continued, a new scheme must be adopted at this meeting. Your Directors, fortified by experience, unhesitatingly recommend its renewal in a permanent form for the election of three Employee Directors—one salaried official and two workmen—with a provision for its termination if the co-partnership system should not continue to answer its purpose of promoting a true union between employers and employed. A copy of the proposed new scheme will be sent to any proprietor on application to the Secretary. A resolution for its adoption will be submitted to a special general meeting to follow the ordinary meeting on the 9th of August.

The accounts accompanying the report show that £2503 was spent for capital purposes in the first half of the year; £899 being for new and additional meters and stoves. The total capital expenditure on the 30th of June amounted to £805,180, or £26,183 more than the receipts, including the premium capital. The net revenue from the sale of gas was £83,770; the rental of meters and stoves produced £6040; the sale of residuals, £30,349; and a small item of rents brought up the total receipts to £120,215. The following were the principal items of expenditure: Manufacture of gas (including £49,601 for coals and £15,380 for maintenance of works and plant), £72,370; distribution, £10,363; management, £4444—rents, rates, and taxes (£4507) and miscellaneous items bringing up the total to £94,143. Among these items is a sum of £1325 paid to employees under the co-partnership scheme; making, with £1750 paid on account in the December half of last year, a total of £3075 in the twelve months. The balance carried to the net revenue account is £26,071; and the amount applicable for dividend is £20,029. The statements relating to the working show that 65,207 tons of coal were carbonized in the half year. The quantity of gas made was 725,067,000 cubic feet, of which 695,058,000 cubic feet were sold and 704,040,000 cubic feet accounted for. The residuals produced were: Coke, 782,484 cwt., of which 171,063 cwt. (estimated) was used in manufacture; breeze, 18,031 yards (9284 yards used); tar, 666,811 gallons; and ammoniacal liquor, 15,198 butts—the make of sulphate of ammonia being 668 tons.

CO-PARTNERS AT THE CRYSTAL PALACE.

True Socialism.

Socialists with strong and right ideals were in evidence at the Crystal Palace last Thursday; and over them that arch-Socialist (Sir George Livesey) presided. But these particular Socialists have a brand of principles of their own. They claim a share in the industrial wealth of the country; but they covet no man's property, much less do they say that any man should deliver up his rightful possessions in order to enrich them. They believe that every man should do something to earn and to show that he deserves, and is capable of holding, property. There is dignity about their creed; something removed from the sordid, commonplace, and dishonourable notions of the ultra-Socialists, whose voice is now so frequently heard over the land. The Socialists who were at the Palace are a long way on the high road along which property is accumulated, and have been busy there for eighteen years, while the other types of Socialists are still clamouring, and are still empty-handed. These accumulators of property are the representatives of the army of Co-partners of the South Metropolitan and the South Suburban Gas Companies. They own hundreds of thousands of capital in the Companies; yearly they add to their holdings; and by the capital they are creating, they are creating labour for others. By no stretch of imagination can a system be conceived to which the title "True Socialism" could be so correctly applied as this one.

The Co-partners and their wives sat down to dinner at one o'clock; and Sir George took the head at one of the central tables. He had with him the Deputy-Chairman of the South Metropolitan Company (Mr. Simpson Rostron) and Canon Ransford, one of his old personal friends. At the head of another table was Mr. Charles Hunt, who is a Director of the South Suburban Gas Company. Mr. Charles Carpenter, Mr. Frank Bush, Mr. S. Y. Shoubridge (South Suburban), Mr. Charles M. Ohren (South Suburban), Mr. A. F. Browne, Mr. J. Tysoe, and Mr. H. C. Sims (Secretary of the South Metropolitan Co-partnership Committee), and possibly other officials of the two Companies were also present. The Co-partnership Committee itself was, we believe, fully represented. All of the South Metropolitan Workmen-Directors were there—Mr. Henry Austen, Mr. J. A. Butcher, and Mr. C. T. Drumgold; and so were the two Workmen-Directors of the South Suburban Gas Company Mr. W. G. Waller, and Mr. R. Wyllie. Right glad were one and all to see that Mr. Bush was sufficiently well to be present, though one and all equally regretted that he was not strong enough to address them.

As customary, after dinner there were several speeches, beginning with an address by the Chairman. On behalf of the Directors of the two Companies, he bid those present a hearty welcome. He then referred to the time when conditions had the effect of knitting closer relationships between master and men. Those days, he said, seemed to have altogether passed; but he believed that now they had found something which united them, so far as the South Metropolitan and the South Suburban Gas Companies were concerned, in a truer, warmer, and stronger bond than even that which existed in the old times—that was, the bond of Co-partnership. Nowadays, there was much talk of inequality in the distribution of wealth. In their humble way, under the Co-partnership system, they were trying to bring about that better distribution of wealth. He did not at all believe in the proposition that the best way of doing this was to take from the rich and give to the poor. There seemed to him to be a certain want of morality about that plan. Great multitudes of the rich were the poor men of yesterday. Their fathers or their grandfathers were working men; and they became rich by industry, by intelligence, by honesty, and by hard work. If the money they had earned and saved had been taken from them, and given to those who had not earned and saved anything, what would have been the condition of the country now? Take their own Companies for illustration. Several millions of pounds had been spent on building and establishing the works of the South Metropolitan Gas Company, and about three-quarters of a million on those of the South Suburban Gas Company. That money had come from the industrious and thrifty. It had been the means of starting and carrying on the businesses, and had given employment to something like 6000 men in the two Companies. If this money had not been saved, and had not been put into the two businesses, these 6000 men would not have had the work provided for them. In their efforts in the better distribution of wealth, he was pleased and proud that the Directors had met with such hearty co-operation from all ranks of the employees of the two Companies. Those present only constituted a small part of the workmen of the two Companies; but the workmen who were there representing the South Metropolitan Company alone held stock amounting to well over £20,000. That amount of stock was the possession of something like 170 working men—only that of the officers present not being included; and if the holdings of the men present from the South Suburban Company were included, it would probably be found that there was some £25,000 in hard cash represented by the workmen assembled there. The average for each South Metropolitan worker then in the room was about £112. This did something for the men. They had had the responsibility of saving it, and of taking care of it. If £100 was given in a lump sum to a poor man, he would hardly know what to do with it. If he saved the money, he would, by the self-denial, thought, and consideration that he had given to the matter, have got an education in the responsibility of managing property. What the Directors were also looking forward to was that their people might be able to regard the future without anxiety. Sir George here referred to a letter he had received from Sir Fortescue Flannery, one of the Directors of the South Suburban Company, which contained much food for reflection. Among the sapient remarks in the letter was this: "It is not in any way touching on politics to say that the recent elections have shown the spread of Socialistic doctrines, and, therefore, the aspirations of men and women for better conditions of life." Sir Fortescue meant that what was really at the bottom of a good deal of the Socialism was anxiety to get better conditions of life without waiting for those who called themselves Socialists to do something impossible and utterly unreasonable. In their two Companies, they were trying to do this in their own way, and were succeeding. Sir Fortescue also said: "These better conditions of life can only be obtained by personal effort and self-denial. . . . These [the personal effort and the self-denial] are trainings in character; and the advancement in character of the individual is perhaps not the least valuable result of the Co-partnership system. I cannot understand why the system progresses so slowly throughout the country. But at all events it is a success with us." What, added Sir George, the Directors were anxious about was that the Co-partnership system should lift to a higher plane of responsibility, and other things also. President Roosevelt said the other day that what he wanted to see was "a righteous peace in the industrial world." He (the Chairman) thought they could claim that the Co-partnership system had secured "a righteous peace" in this little industrial world of theirs.

Following, came a very happy speech from Canon Ransford, an old friend of Sir George's. He referred to his wife and himself as co-partners, and said their richest wealth was their children. The first four words in the Bible were: "In the beginning, God." Their children were their richest treasure; and he entreated those present to let their children understand that, in the beginning of their lives, in the beginning of their education, in the beginning of their career, in the beginning of every day and every week, God should stand. "In the beginning, God." With Him they were co-partners in the great work of the world.

Testimony to the immense good the Co-partnership system had effected in the two Companies was borne by Mr. Charles Hunt. He said it promoted the best of feeling between employers and employed, without which no industrial enterprise could hope for a full measure of success. He was sure, seeing as he had done the gradual growth of savings among the employees of the South Suburban Gas Company, that many of them would have reason at some time to bless the day that this system was inaugurated. It was a source of great satisfaction that the system was growing in stability and solidarity as time went on, though naturally they could not expect that the bonus would increase year by year. Unfortunately, they had now to look forward to a possible reduction of bonus; but he thought that was only to be regarded as a passing cloud and render the future sunshine all the more acceptable.

Two representatives of the South Metropolitan men spoke—Mr. Beard, of the Bankside station, proposing a cordial vote of thanks to the Chairman and Directors, the Engineers, and Secretary, and all officially associated with the scheme; and Mr. Wenbourne, of East Greenwich, seconding it. Of Co-partnership as the best means of bringing capital and labour together, neither could possibly have declared their views in higher terms. On behalf of the South Suburban Company, Mr. W. G. Waller (of the Workmen-Directors) spoke. He expressed his appreciation of the Co-partnership system, and described it as the only practical solution of the labour problem. They were all well aware that the eyes of the industrial world were fixed upon these two Companies, to see if the Co-partnership system and the Workmen-Directors were a success. He was sure they all wished the system should be a success, not only for themselves, but for the benefit of the working classes throughout the world.

The vote of thanks was very heartily passed.

The pleasure of returning thanks for the vote, on behalf of the Chairman and Directors of the two Companies, fell to Mr. Simpson Rostron, the Deputy-Chairman of the South Metropolitan Company. He said the heart and soul of this movement was their Chairman, with whom he had been associated now for nearly thirty years, and whose efforts in this direction he (Mr. Rostron) had done his best to support and second. He had done so because he believed it was an excellent movement, and brought the workmen and the Directors together on terms of good feeling and social intercourse.

Before calling upon Mr. Carpenter, the Chairman referred to the serious illness through which Mr. Bush had passed, and said they were very grateful that he was able to be with them that day. But it would not be wise for Mr. Bush to speak, as he was not strong yet; and they must not run any risks with him. In Mr. Bush they had a true friend. He had been his (Sir George's) trusted friend in connection with the South Metropolitan Company for a good many years; and he was a friend to all the officers and employees.

With a word of regret that he was not to have the pleasure of following his colleague Mr. Bush, Mr. Carpenter stated that, from the point of view of steadfast belief in the value and great good which the Co-partnership system had been to the South Metropolitan Company, he yielded to no one. One statement that had been made might be open to a little misapprehension. It was said that the workmen present in the room, with their wives, had £25,000 of savings in the two Companies. This statement alone would not be of any great interest to him, nor did he think that any very great value could be attached to it. It would simply imply that the amount of money had been saved, and had been put by for safe keeping in the coffers of the Companies. But there was a matter of much greater importance—that the £25,000 referred to was held by the workmen present in shares in the Companies as part of the capital; and he thought that was a very different thing indeed to having £25,000 of savings in the Companies. It had also been mentioned that, owing to several matters, chief of which was the rise in the price of coal, the bonus for the ensuing twelve months could not be at the same rate as that which they had all taken for the past year. It behoved them to do the best they could, in order, as far as possible, to counteract the pernicious influence of the rise in the price of coal.

As the chief officer of the South Suburban Gas Company, Mr. S. Y. Shoubridge expressed gratitude for the advantages that all the Co-partners enjoyed. Among his remarks, he said that Sir George had frequently told them that, if the Co-partnership system was to continue, it must be beneficial to the three orders of Co-partners—the shareholders, the consumers, and the employees. He was glad to say that this half year they, of the South Suburban Company, were able to verify Sir George's predictions in all respects; for not only had they received the largest bonus they had ever had—6½ per cent., or nearly £3100, but they had made the largest profit that had ever been made in the history of the Company, while the price of gas had been the lowest on record. This, he thought, amply proved what Sir George had predicted would be the result of true Co-partnership, that all the

three orders of co-partners would benefit. It was a matter of profound satisfaction that they had been able to produce this result.

Prefacing a speech from Mr. Austin, one of the Workmen-Directors of the South Metropolitan Company, the Chairman bore testimony to the fact that the Workmen-Directors of both Companies had acted justly, fairly, and straightforwardly towards the interests of all classes —consumers, shareholders, and workmen alike, and not in any narrow-minded class spirit. He added that the employees now had a share not only in the profits, but also a share in the responsibility of management; and better Directors could not be found, if one searched England through, than the four workmen and one official the employees had selected from among themselves.

In a spirited speech, Mr. Austin gave some interesting statistics, showing the remarkable progress of the Co-partnership system. He said that during the past eighteen years, the Co-partners had received, with this year's bonus, £390,000. This year the bonus would amount to £45,000; and if the men of the South Metropolitan Company did as well this year as last, they would have put £88,000 into stock in two years. Last year they had £43,000, and £42,000 was put into stock. This year £45,000 was being distributed; and he hoped every penny of it would go into stock. Then he came to the savings, and £132,000 had been saved during the past seventeen years. The interest upon their savings had amounted to £23,544; and, by way of dividend upon their stock, they had £55,000. Could anyone have predicted eighteen years ago that there would have been stock passing through the Co-partnership pass-books amounting to £601,547—over half-a-million of money had passed through the Co-partnership system.

The gratifying announcement was made by Mr. H. C. Sims, the Secretary to the Co-partnership Committee of the South Metropolitan Company, that the whole of the withdrawable bonus allotted for last year remained untouched.

With a few concluding words from the Chairman, the happy party separated, to enjoy the delights of the Palace and grounds until they reassembled for tea. Afterwards most of them remained to see the famous firework display. The day was exceptionally fine; and all the employees proved themselves as efficient Co-partners in pleasure, as they are in honest daily work and in its fruits.

PRICE OF GAS IN BOSTON (MASS.).

The Working of the Sliding-Scale and Profit-Sharing.

Readers may remember that some time ago the Boston Consolidated Gas Company adopted the sliding-scale system, which has been found to work to the advantage of both the Company and the consumers. During the past two years, four reductions, each of 5c. per 1000 cubic feet, have been made in the price of gas; the last one, which came into operation on the 1st ult., bringing the charge down to 80c. This will mean a saving of about $800 000, compared with the price charged before the local Companies were consolidated two years ago, as noticed in the "JOURNAL" at the time. The Company have some customers who use, on an average, less than 50c. worth of gas per month, and who, therefore, are a source of loss. Consequently, to partially meet this, these consumers will be charged a sufficient sum for the use of the meter installed on their premises to make the total charge for gas and for the use of the meter not less than 50c. By this reduction, the Company, under the sliding-scale, may increase their dividend to 9 per cent. per annum on their 151,106 shares as from July, 1908. For the financial year ending June last year, the Company paid 7 per cent. on their stock; and for the current year 8 per cent. will be paid by virtue of the reduction made in the price a year ago. The Act provides that with every full year's 5c. reduction in price, the Company may increase their dividend rate by 1 per cent. the subsequent year, should the earnings allow of it.

Mr. Louis D. Brandeis, a member of the Public Franchise League—an organization the object of which is the guarding of the public interests in connection with gas legislation—has lately referred with much gratification to the action of the Company. In the course of his remarks he said: "The reduction in the price of gas just announced by the Boston Consolidated Gas Company, from 85 c. to 80 c. per 1000 cubic feet, is an event of more than local or passing significance. The reduction follows quickly after three other reductions in price within a period of two years—the first on July 1, 1905, from $1 to 95 c.; the second on Jan. 1, 1906, to 90 c.; and the third on July 1, 1906, to 85 c. To have made a reduction in price of 20 per cent. during so short a period, in which prices for labour and materials have risen so largely, is certainly a remarkable achievement. It will mean a saving to the people of Boston next year of $800,000 over what gas would have cost them at the old price of $1 if the estimated consumption of 4 billion cubic feet is reached. Fortunately the results to the stockholders of the Company have also been eminently satisfactory; and they may hope soon, under the law, to reap their just share of this remarkable achievement. . . . Gas properties which for the greater part of twenty years had been the subject of financial and political scandal and corruption, exciting the bitterest hostility on the part of the people, have been conducted in a manner so honourable as to deserve and to secure the highest commendation on all hands. The officers and employees of the Company, instead of engaging in lobbying and other political activities, have devoted themselves strictly to the business of making and distributing gas, and with such ability and good effect as to attain in an almost incredibly short time for the people cheap gas, and for the investors security and the prospect of large returns. These remarkable gains are the direct result of the wise, progressive, and efficient management of President Richards and his associates, operating under the wise and progressive legislation promoted by the Public Franchise League. It was well worth the three years' strenuous efforts of the League to have secured the low capitalization and the sliding-scale law under which the Consolidated Company has in a true sense become a partner of the community. The interests of the gas consumer and of the stockholder have become identical; and President Richards and his Directors have, with great wisdom, extended this partnership also to the employees. Their system of profit-sharing must have been potent in securing loyal and efficient work without which such results could not have been attained. President Richards has, by establishing the practical success of the sliding-scale law—the passing of which he and the Public Franchise League co-operated to secure—furnished to the whole country an alternative for municipal ownership. The Boston example is sure to be followed soon elsewhere. If we could have more wise legislation like this, and our public service corporations were managed by men of the ability, enterprise, and public spirit of President Richards, the cry for municipal ownership would soon subside. He has shown that a man may become recognized as a most useful public servant while engaged in the business of making money for his stockholders, and that the surest way to make money in public franchise corporations is to co-operate with, instead of antagonizing, the people."

Referring to the reduction, the "Boston Transcript" said: "The success of the sliding-scale plan for regulating the price, by which investors and consumers share the benefits of all economies of operation, is full of suggestiveness for other public service enterprises. Under the old system, managers of such a corporation as this were half-afraid to avail themselves of any unexpected economy, especially if it threatened to be temporary, lest the State Commission having its business in charge, or the Legislature, should seize on such results as an excuse for ordering a substantial reduction in price to the consumer, when perhaps business conditions might soon change so that this rate would be oppressive. This sort of State supervision did not develop the best talent and resourcefulness of the managers of a public service corporation. The sliding-scale scheme has done just that. . . . In this period of advancing prices on every side, it is exceedingly gratifying to have one commodity of every day use move in the other direction. In announcing this reduction, the Company take into account the expected increase in consumption of the succeeding year, not only from the growth of population, but from the added inducement which this lower rate gives to the use of gas for cooking and other domestic purposes. No wonder the advocates of the public ownership of gas supply opposed the sliding-scale. It is showing how the best results for the public can be obtained through stimulating the best energies of the private owners of the huge Consolidated Corporation Gas at 75 c. will probably be possible in a few years."

PUBLIC LIGHTING IN ISLINGTON.

Gas Preferred to Electricity.

At a meeting of the Islington Borough Council last Tuesday, the Special Committee appointed last December to inquire and report on the position, financial and otherwise, of the electric light undertaking, including the scheme for the extension of street arc lighting adopted by the late Council on March 2, 1906, presented an interim report dealing with the scheme referred to. It was to light 15 miles of streets (then lit by gas) by electricity, and to displace 714 incandescent gas-lamps, at an estimated total cost of £21,011. After the most careful inquiry, the Committee had arrived at the following total annual cost of the scheme: Interest and redemption charges in respect of installation, £1311; cost of current, £1660; cost of carbons and maintenance, £1520—total, £4491. The annual cost of the 714 gas-lamps (proposed to be displaced), for gas and maintenance, was £2376 per annum. The contracts entered into by the authority of the late Council amounted to £14,574; and of this total the value of the material actually received up to May 11 was £7443—leaving material of the value of £7131 yet to be delivered. Altogether, the amount to which the Council were not yet committed was £5328. The Electrical Engineer (Mr. Albert Gay) reported that the maximum load on the plant in 1906-7 was 3000 kilowatts; that increased output resulting from the adoption of the scheme would bring the maximum load to 3250 kilowatts; and that the total capacity of the station when the turbine was running was 5100 kilowatts. He further stated that the reserve should equal the capacity of the largest unit of plant—viz., 1500 kilowatts. This, if the scheme were carried out, would leave a working margin of 350 kilowatts. It was therefore obvious that the additional production contemplated by the scheme would render more urgent the laying down of further plant in the near future; and it was estimated by the Electrical Engineer that, apart from the scheme, an expenditure of from £12,000 to £15,000 for generating plant would probably have to be incurred during the year 1908-9. A portion of the scheme had already been carried out; and its total yearly cost would be £1348. Against this, was to be placed a sum of £809 which used to be paid to the Gas Company—leaving a net yearly charge on the rates of £539.

After an exhaustive examination of the scheme, the Committee arrived at the following conclusions: (1) That the scheme was ill-conceived, and, if carried out, would be detrimental to the interests of the borough; for while it was admitted that the general rate would benefit to the extent of £505 per annum by the displacement of the gas lighting, this could only be effected at a cost of £2620 per annum to the undertaking. The Committee were informed that the profits of the undertaking for the past year amounted to £1500; so it would be seen that with the scheme in operation there would be a deficit, for which the general rate would be responsible. (2) That the streets affected by the scheme were already well lit by incandescent gas, and no case had been made out for the use of a more expensive illuminant. (3) That the probable demand for current by private consumers in the thoroughfares in question was so small that the large outlay represented by the apportionment for private lighting was not justified. (4) That the adoption of the scheme would prevent the possibility in the future of any appreciable reduction in the lighting rate, which it was admitted had been excessive. The Committee were therefore of opinion that the scheme should not be further proceeded with. In the event of the Council agreeing to this, the question of the disposal of the stock remaining in hand and yet to be delivered had to be considered. The total value of the material thus to be dealt with was £10,254; and of this sum cable represented £8104. The Electrical

Engineer informed the Committee that he could take into stock for immediate or for almost immediate use cable to the value of £3214; and the bulk of the remainder of the cable could be employed apart from the scheme in the course of the next two or three years. Altogether, including the interest chargeable on the material retained in stock, the net immediate loss arising from the abandonment of the scheme was put down as £331. The Committee made recommendations in accordance with their conclusions.

In moving the adoption of the report and recommendations, Mr. Cowling said the £21,000 was only the beginning of a huge scheme for lighting the whole of the borough at a cost of £250,000. The lighting had increased by leaps and bounds. In 1895 it was done at a cost of £14,430 for gas; in 1907 it cost £34,814, exclusive of interest and repayment of loans, which were equal to a 2d. rate. He did not say that the borough was properly lighted in 1895; but he would point out that while 101 miles were well lit by the incandescent system at a cost of £16,140—*i.e.*, for about £160 per mile—electric light cost £810 per mile. There was a subsidy for electricity from the general rate, which a private undertaking could not have, and which would convert the so-called profit of £1800 into a loss. It had been stated that the Committee's recommendations were submitted for the purpose of wrecking the undertaking; but he denied this. At the same time, the Committee realized that the undertaking was trembling in the balance. It was contended by several speakers that the figures in the report were not to be relied upon, and that it would be a waste of public money if the Council were to abandon the scheme, after having spent so much money upon it.

Several amendments were defeated; and, in the result, the Committee's report and recommendations were carried by 37 votes to 13.

PUBLIC LIGHTING AT TOTTENHAM.

Improvement Sanctioned.

As already reported in the "JOURNAL," the Tottenham Urban District Council on the 18th of June received from their Engineer (Mr. W. H. Prescott) a report upon the public lighting, and it was resolved to send a copy of it to the Tottenham and Edmonton Gas Company for their observations. At the meeting of the Council last Thursday, a letter was received from Mr. A. E. Broadberry, the Company's Engineer and Manager, in the course of which he said there was nothing in the report to criticize adversely, and it contained much interesting detail. Comparisons were made with Wood Green, Edmonton, Leyton, Hornsey, and Walthamstow; he believed it was with Hornsey only that comparison was intended. Mr. Broadberry then proceeded as follows: "The fundamental difference is that in Hornsey the Corporation do the lighting themselves, simply paying for the gas to the Gaslight and Coke Company 27s. 9d., and to the Hornsey Gas Company 27s. 4d. per lamp. This works out at 2s. 2d. per 1000 cubic feet for the Gaslight and Coke Company, and 2s. 1½d. for the Hornsey Company. I understand the former Company's price is to be raised to 2s. 5d. After deducting our lighting and cleaning costs, we have 1s. 11·32d. per 1000 cubic feet for our gas. I believe the Council desire, as far as possible, to work with direct labour; and if means can be found for satisfactorily transferring the work, and guarding against waste of gas, we can have no objection, so long as we receive 2s. 5d. per 1000 feet for the gas. The only difficulty would be overcome if the Council would take over the Rostin lighters, of which there are about 800, at the cost price of 50s. each, or continue to pay the present rates for them and take over the remainder of the lamps. The next comment must be in regard to the hours of lighting and extinguishing. The lighting agreement calls for all lamps to be alight half-an-hour after sunset. This means starting to light three-quarters of an hour before the sun goes down. The agreement also calls for all lamps to continue to burn until half-an-hour before sunrise. This means that some must still be burning until the lamplighter finishes his round three-quarters of an hour after the sun is up; but they do not do this at Hornsey. Cutting down from 4144 (which is the ascertained number of hours we have found necessary to fulfil the agreement requirements) can be done by extending the Rostin system. During the last year the average number of hours by that system was 3744, or exactly 400 hours less than by hand work. No reduction has been made to the Council on account of this, because it is partly our repayment for the expense of installing the Rostin lighters; but if the Council will take over the apparatus, we can at once make the reduction. Another point in regard to the cutting down of the hours is that the cost of wages for painting, lighting, extinguishing, cleaning, supplying mantles, glasses, and repairs to lanterns remains the same; and economizing on one item at the cost of general efficiency appears to me bad economy. With regard to the 'C' burners, for general all-round work it is difficult to beat them; and as they were applied in the old existing lanterns, many of them thirty to forty years old, it, in combination with the bulb set, was the only possible application of incandescent lighting. No one, however, would advocate them in preference to some of the modern burners and up-to-date lanterns for brilliancy and efficiency. But the Council still continue to order the old type of lantern; and the 'C' burner and the bulbs are the only suitable accompaniment. The lanterns the Tottenham Council order are the plain 14-inch ordinary lamps costing 8s. 6d. each; whereas those at Hornsey, made by the Council's own men at less than ordinary selling price, cost 23s. 6d. I believe the reason for continuing with the old pattern is that in the new streets the estate owners have to supply the lamps; and a difficulty has been felt in compelling them to put into back streets better lamps than have existed in the older main and secondary roads. The best recommendation in regard to this which I can make is that, on condition that the Council will make an extensive sweep of the old 14-inch lanterns, we supply them with 17-inch Lucas 200-candle power self-intensifying lamps at something under cost price. The consumption of gas will be 6 cubic feet per hour, against the present 3½ cubic feet; but the cost of the mantles, labour, and other items being the same, a far brighter light will be secured at a slightly increased cost. This would make Tottenham one of the brightest spots in London; and I believe that is what its Council wants it to be."

The Council's Engineer stated that he had considered the foregoing communication. If the system in operation at Hornsey was adopted for Tottenham, the Gas Company would, as stated, increase the charge for gas from 1s. 11·32d. to 2s. 5d. per 1000 cubic feet, which would mean an increase in the cost of gas of 8s. 1d. per lamp per annum. With regard to the Rostin automatic system of lighting and extinguishing the public lamps, adopting the figures supplied by the Company, it caused a saving of 400 hours' lighting for each lamp per annum; and as 800 lamps were fitted with it, the saving of gas was equal to £108 17s. 8d. per annum. In addition, as the cost of the upkeep and maintenance of each of the lamps referred to was 6s. less than under the old system, a further saving of £240 was effected by the Company. Thus for the expenditure of £2000 (the cost of installing the Rostin system on the 800 lamps), the Company made a total saving of £348 17s. 8d., and the Council did not receive any benefit therefrom. As to the suggestion that the Council should make an extensive sweep of the existing lanterns in the district, this would involve an expenditure of about £3500 to provide the 17-inch Lucas 200-candle power self-intensifying lamps; and, in addition, the extra 2½ cubic feet of gas per hour consumed by these lamps would increase the Council's gas bill for public lighting by £1800 per annum.

The General Purposes Committee had considered the Company's reply and also their tender for the public lighting and the maintenance of the lamps, and were of opinion that no pecuniary advantage would accrue to the district by the adoption of the system in operation at Hornsey; and they recommended the Council not to entertain the proposal. As to the Company's tender, having regard to the current price of coal, the Committee recommended that the terms quoted by the Company in their letter of the 18th of June be accepted; and that they be requested to adopt some other system for the renewal of mantles, so as to ensure an improvement of the lighting of the district. With regard to the proposal to adopt 17-inch Lucas lamps throughout the district, the Engineer suggested that the public thoroughfares of the district should be divided for lighting purposes into three classes: (1) The main roads and a portion of West Green Road to be lighted with electricity. (2) Contributory or secondary roads to be lighted with 17-inch Lucas 200-candle power self-intensifying lamps in lieu of the existing "C" burners, entailing an initial expenditure of £250 for new lanterns and burners, and increasing the total cost per annum by £75. (3) Side roads to be lighted as at present, and the lanterns proposed to be removed from the contributory roads to be reused in new streets. The Committee recommended the Council to adopt the Engineer's suggestions.

To the motion for the adoption of the report and recommendations, an amendment was moved to the effect that the consideration of the matter be adjourned until the Council's Engineer presented a scheme on the question of direct labour. After some discussion, however, it was negatived, and the motion was carried.

Automatic Controller Test for Liverpool.

At the last meeting of the Liverpool City Council, there was some discussion on the subject of the lighting and extinguishing of the public lamps. Sir Charles Petrie called attention to a report drawn up by the Lighting Superintendent (Mr. A. G. Smith) on a proposed scheme to equip a number of the street-lamps with automatic lighting and extinguishing apparatus, and said it was contended that a saving would be effected by the application of this principle. According to the estimate, there would be 18,513 controllers and 13,900 new lamps, and a capital expenditure of something like £37,458 would be required. Taking credit for 13,900 old lamps at 7s. each, the expenditure would be brought down to £32,593. The subject had come before the last meeting of the Lighting Committee; and it occurred to him that it was a very large sum of money to expend without having made any experiment whatever. Two members of the Committee, together with Mr. Smith, visited certain towns—Folkestone in particular—to observe the system of automatic controllers at work; and they also went to Bristol, where the clockwork arrangement necessary for the contrivance was manufactured. The Lighting Engineer had patented a particular lamp, which it was claimed could be effectively worked on this system; and it was estimated that the saving in labour and gas by the adoption of the system would be £10,537 a year. He was sorry they did not distinguish between the two headings of economy, as he would have liked to know how much would be saved in labour and how much in gas. Other economies, it was claimed, would bring the total saving up to £13 653. He had opposed the recommendation because he felt they had not had sufficient experience of the system. He proposed an amendment that they should try as an experiment 250 of the appliances, which, he suggested, should be subjected to a severe test at the Pierhead, in Lime Street, or at other exposed places. One of the subsequent speakers remarked that the sanctioning of the scheme would make them less able to adopt more generally the electric light. They would be putting themselves in the hands of the Gas Company for an interminable period. The amendment was carried by a large majority.

Thefts from Prepayment Gas-Meters.—At the County of London Sessions last Tuesday, Abraham Myman, a tailor, and Philip Zukerberg, a presser, were indicted for stealing 1s. 2d., the property of the Commercial Gas Company. Myman pleaded "Guilty." Mr. Huntly Jenkins, who appeared for the prosecution, said the money was taken from an automatic gas-meter, the property of the Company, in an unoccupied house in Sanders Street, Stepney, on the 14th of July. The Jury found Zukerberg guilty. Mr. Jenkins mentioned that within the last six months there had been 1700 robberies from prepayment gas-meters belonging to the Company. Prisoners were each sentenced to three months' imprisonment with hard labour, and to be recommended for deportation at the expiration of their sentences.

GLASGOW CORPORATION GAS SUPPLY.

Annual Report of the Gas Committee—Accounts for the Year.

The Thirty-Eighth Annual Report by the Committee on Gas Supply, which embraces the year from June 1, 1906, to May 31, 1907, was submitted to the Town Council on Thursday last, and is in the following terms.

I.—FINANCE.

The gross revenue amounts to		£865,470
and the gross expenditure to	£662,554	
to which is added depreciation written off capital assets	54,668	
		717,222
The balance carried to profit and loss account being		£148,248
The Committee had to meet the following requirements during the year.		
(1) Annuities on stocks, so far as not redeemed and not converted	£22,382	
(2) Contribution to Corporation loans fund, in respect of Glasgow Corporation 3 per cent. stock redeemable in 1921, issued in lieu of converted gas annuities	8,422	
(3) Interest on borrowed money and redeemed loans	65,981	
(4) Sinking fund	48,075	
		144,860
Leaving a surplus on the year's operations of		£3,388
This surplus added to the balance at the credit of profit and loss account, carried from the previous year's account, viz.		12,789
leaves to be carried to the credit of next year's profit and loss account the sum of		£16,177

Tar and Liquor.—Your Committee regret that the market for residuals has been unfavourable to the Corporation during the past year, and the income from this source has decreased £1484. The average price received per ton of coal carbonized this year was 3s. 2·934d., as compared with 3s. 5·059d. for the previous year—a decrease of 2·125d. per ton. The respective leases of the Dawsholm and Tradeston Chemical Works, and the contracts for the purchase of the tar and ammoniacal liquor produced at these works having expired as at June 30 last, your Committee have pleasure in reporting (1) the sale of the residuary products at Dawsholm Gas-Works and the lease of the chemical works there for a period of five years from June 30 last to Messrs. James Ross and Co., at an enhanced price; and (2) that the sale of products at Tradeston Gas-Works and the lease of the chemical works there has been continued to Messrs. Robinson and Hunter for a period of one year from June 30 last, also at an increased price.

Coke.—The sum realized from the sale of coke this year amounts to £89,588, an increase of £9208 over that of the preceding year; this being due to the greater quantity sold and a higher price per ton obtained. The quantity of coke sold last year was 302,759 tons, as compared with 274,905 tons for the previous year; being an increase of 27,854 tons. The average price received was 6s. 7·23d. per ton, as compared with 6s. 5·04d. for the previous year; being an increase of 2·19d. per ton.

Coals.—Your Committee advertised for tenders for coal to be supplied during the coming year, and have concluded contracts for almost the whole quantity required, but at prices much in advance of those of last year. The quantity of coal carbonized during the year amounted to 740,492 tons, as compared with 712,097 tons for the preceding year—an increase of 29,395 tons.

Sinking Fund.—Your Committee applied £16,253 of the amount at the credit of the sinking fund to the extinction of £5999 of £9 per cent., and £220 of £6 15s. per cent. gas annuity stocks; and the annuities formerly payable upon these stocks now cease to be a charge upon the revenue of the Department. There has also been redeemed during the year, by the application of moneys at the credit of the same fund, £4084 of Glasgow Corporation 3 per cent. stock, and a further amount of £21,925 of loans raised under the Glasgow Corporation (Tramways and General) Order Confirmation Act, 1901, and the Glasgow Corporation Order Confirmation Act, 1905. The amount added to the sinking fund during the year was £63,355. The sinking fund, with its accumulations, now stands at £668,252, of which there has been already applied in the redemption of borrowed money, £3 per cent. stock, and annuities, £594,060; leaving still available for either of these purposes the sum of £74,191.

Price of Gas.—In view of the great advance which has taken place in the price of coal, which forms the principal item of expenditure, resulting in an increased cost to the Corporation of upwards of £100,000, your Committee regret that they have to recommend to the Corporation that the price to be charged for gas for the current year as from the date of the last survey, be as follows—viz.: (1) Lighting and domestic purposes: Within the city and suburbs generally, 2s. 4d. per 1000 cubic feet; within the Milngavie area of supply referred to in the Glasgow Corporation (Gas, &c.) Order Confirmation Act, 1902, 3s. 4d. per 1000 cubic feet. (2) Motive power purposes: Within the city and suburbs generally, 2s. per 1000 cubic feet; within the Milngavie area of supply, 3s. per 1000 cubic feet. (3) Manufacturing purposes: For manufacturing purposes, other than for lighting and domestic purposes, within the city and suburbs generally, 2s. per 1000 cubic feet; within the Milngavie area of supply, 3s. per 1000 cubic feet. Where the supply of gas is given for manufacturing purposes, such supply shall be measured through a separate meter; and the minimum amount payable therefor annually and in advance shall not be less than £3. (4) Supply through prepayment meters: 2s. 11d. per 1000 cubic feet.

Sale of Gas.—The following is an analysis of the sale of gas for the past year, as compared with the previous twelve months:—

	Rate per 1000 C. Ft.	Year 1905-6. Consumption.	Rate per 1000 C. Ft.	Year 1906-7. Consumption.
	s. d.	Cubic Feet.	s. d.	Cubic Feet.
I.—Within the city and suburbs generally:—				
(1) Lighting	2 1	4,953,185,900	2 1	4,975,227,700
(2) Gas-engines	2 0	2,997,300	2 0	—
(3) Do.	1 9	351,454,700	1 9	359,248,400
(4) Manufacturing purposes	1 9	85,658,100	1 9	164,670,300
(5) Contract gas	2 1	527,302,550	2 1	544,322,240
II.—Within the Milngavie area:—				
(6) Lighting	3 1	15,809,700	3 1	16,378,900
(7) Gas-engines	2 9	496,400	2 9	458,500
(8) Manufacturing purposes	2 9	743,100	2 9	1,339,000
(9) Contract gas	3 1	1,380,850	3 1	1,531,620
III.—Prepayment supply	2 6	40,908,433	2 6	167,946,666
		5,979,937,033		6,231,123,326
Used at works		73,008,500		77,450,300
		6,052,945,533		6,308,573,626
				Increase, 255,628,093 = 4·22 per cent.

In the above analysis of gas consumption, a gratifying feature is the increasing demand for prepayment gas supply; the increase being 127,038,233 cubic feet.

The number of gas-engines in use and the total horse-power, for this year and the preceding year, were as follows:—

	Number.	Brake Horse Power.
May 31, 1906	1,778	16,209¾
May 31, 1907	1,727	17,157⅝
	Decrease 51 = 2·87 p. ct.	Increase 948¼ = 5·85 p. ct.

II.—WORKS.

The works and mains have been maintained in an efficient condition out of revenue during the year. The greatest quantity of gas sent out during the year in twenty-four hours was 36,179,000 cubic feet. The maximum daily make was 32,022,000 cubic feet. The quantity of gas made per ton of coal carbonized was 9391 cubic feet, as compared with 9416 cubic feet for the previous year. The loss by unaccounted-for gas during the year was 9·28 per cent., as compared with 9·72 per cent. the preceding year. Upwards of 23 miles of new mains have been laid during the year.

The number of meters in use on May 31, 1907, was 256,239; being an increase of 13,955 over the number in use at the same date last year. There are now in use 229,062 ordinary and 27,177 automatic or prepayment meters. During the year, 25,926 meters were repaired, and 9300 were examined while in use, of which 7484 were found in a satisfactory condition, and 1816 were found defective and removed. The number of gas-stoves on hire as at May 31, 1907, was 39,216. There are also 3216 stoves and small grills let out free of charge. The number of gas heating and cooking appliances sold during the year was 3101. In view of the large increase in the demand for gas, the questing of providing considerable extensions of producing plant will require to be considered in the near future. Part of the old works at Dalmarnock is being repaired and put into working order, so that it can be used if necessary to assist the other works at the time of the heaviest demand during the ensuing winter.

The stock capital is stated at £300,000 bearing annuities at the rate of 9 per cent., and £115,000 bearing annuities at the rate of 6¾ per cent. The total amount of annuities was originally £34,762 10s., but is now reduced to £21,900 16s. by the operation of the conversion scheme and sinking fund; the stock capitals being left at £188,690 and £72,870 respectively. The loan capital amounts to £4,200,000, of which £1,400,000 is for electricity purposes. For the Gas Department, there has been borrowed, out of the Corporation Loans Fund, £1,527,015; and of this there has been redeemed £322,985. There remains to be borrowed for gas purposes £850,000.

The amount of capital expenditure during the year was £62,429. Of this sum, £4133 was expended at Dawsholm station and works, £64 at Tradeston, £2677 at Provan, £106 at Provan chemical works, £15,316 upon pipes and cost of laying, £28,577 upon meters, and £13,135 upon gas-stoves. The depreciation written off during the year amounted to £54,668. Dalmarnock station and works have been depreciated from £257,708 to £57,597—the amount written off during the year having been £749. Dawsholm station and works have been depreciated from £566,745 to £282,850, Tradeston station and works from £340,885 to £175,068, Temple station and works from £233,573 to £165,618, and Provan station and works from £780,037 to £745,449. Pipes and cost of laying have been depreciated from £824,842 to £480,958, gas-meters from £527,523 to £222,335, and gas-stoves from £148,642 to £60,968.

In the revenue account there is shown, as derived from the sale of gas, £641,063—an increase of £27,431; from coke, £89,588—an increase of £9208; from ammoniacal liquor and tar, £122,687—a decrease of £1484; and from stove-hires, £6953—a decrease of £1859. The total revenue was £865,470—an increase of £33,300. On the expenditure side, the cost of coal was £360,432—an increase of £19,066; purifying materials, and oil, water, and sundries at works cost £33,134—an increase of £601; salaries of engineers, superintendents, and officers at works amounted to £5021—an increase of £235; repairs and maintenance of works and plant, machines, apparatus, tools, material-, and

labour, cost £58,659—an increase of £77; and wages cost £79,854—an increase of £4464. The total cost of manufacture was £539,925—an increase of £24,596. Distribution cost £62,809—a decrease of £1914; in the stove account the expenses chargeable to repairs amounted to £10,804—an increase of £2639; rents and feu-duties amounted to £8561—an increase of £194; rates, assessments, and taxes were £23,926—an increase of £1149; management cost £14,074—an increase of £1496; law and parliamentary charges amounted to £654—a decrease of £223; and retiring allowances, to £1799—an increase of £254. The total ordinary expenditure was £662,554—an increase of £28,193. The depreciation of £54,668 was distributed as follows: On gas-works, at 1¼ per cent., £18,283; on chemical works, at 2½ per cent., £2405; on pipes, at 2½ per cent., £11,939; on stoves, at 10 per cent., £12,367; and on premium, at 2½ per cent., £4358. Adding the sum allowed for depreciation to the ordinary expenditure, the amount on the expenditure side is raised to £717,222, which is greater than the corresponding figure of last year by £24,617. The balance carried to profit and loss account is £148,248, which is £8682 more than a year ago.

Gas was manufactured as follows: At Provan, 2,163,041,000 cubic feet, as compared with 1,941,913,000 feet in the previous year; at Dawsholm, 2,773,102,000 cubic feet, as compared with 2,781,752,000 feet; and at Tradeston, 2,017,825,000 cubic feet, as compared with 1,980,879,000 feet.

Debate in the Council.

Ex-Bailie CALDERWOOD, the Convener of the Gas Committee, in submitting the accounts, said they showed the finances of the Gas Department to be in a very favourable condition. They had still to report, so far as tar and ammoniacal liquor were concerned, that the market had been very low, and that there had been a decrease in the return of £1484. During the year the leases expired both at Dawsholm and Tradeston, in connection with that department. They advertised; and the result was that they had accepted offers at increased rates. A considerable addition was looked for from those products. They had been very successful in the coke department; having realized £89,588—an increase of £9208, which was very satisfactory. There had been a few complaints about the quality of the coke; but he thought the figures showed that the public, in spite of all its faults, still felt a desire to have it. He was very glad to be able to say that in the year to come they expected to have a considerable increase of income from this source, as they anticipated better prices. There was one thing the Committee had to regret—that they had this year to meet a very large advance in the price of coal, and that the Committee had thus no alternative but to recommend the Corporation to add 3d. per 1000 cubic feet to the price of the gas. They were sorry they had to do this; but they could not help themselves. The increase in the price of coal meant to them something like £108,000 in the course of the year. He would like to call their attention to the abnormal increase of business in connection with prepayment meters. In the year before last, they sold about 41 million cubic feet through those meters; last year they sold 167,946,666 feet—an increase of about 127 million cubic feet. There had been a very great increase in the number of prepayment meters. Two or three years ago, they had only a few thousands of them; while at present they had 27,177 such meters altogether. They did not wish to push the prepayment meter; they intended to put them only into tenements where there had not been gas before. They did not want, where a meter was in use, to make any change; and he thought the consumers would themselves agree with this, because they had to pay considerably more for their gas if they used a prepayment meter. They proposed to increase the price of gas used in connection with prepayment meters by 5d. per 1000 cubic feet, making it 2s. 11d. Some might take exception to the proposal to put 5d. on to gas used through prepayment meters, and only 3d. upon that consumed through ordinary meters. But with ordinary meters the increased charge would be as from April last; while in the case of prepayment meters they would require to make an alteration in the meters, and until this was done the consumers who had those meters would be having gas at the old rate. It would be four or five months from last April before the new charge would come upon them. The cost of altering the meters would be nearly £1000. They did not propose to alter the meters again should gas come down in price, but to give the consumers so much back on the amount in the meter. The number of gas-stoves in use was increasing. They had now 3216 small grills and stoves given out free of charge; and these had been a great benefit to the poorer classes. In view of the large increase in the demand for gas, the Committee had been taking into consideration the desirability of extending the producing plant—of course, at Provan. There had been an increased output of gas last year of over 250 million cubic feet. When they considered a town like Perth, where they had an output of somewhere about 200 million cubic feet during the year, and when they considered a town like Kilmarnock, where they had an output of something like 190 million cubic feet in a year, they would see what a very large increase they had in Glasgow. In spite of all the difficulties they had to encounter in the Gas Department, their output of gas was still increasing; and he hoped this would long continue, because their revenue was chiefly from gas. They had been sometimes told that the gas accounts were not in a condition to be easily understood. A Committee had been appointed to consider this subject, and had had several meetings; but they had not yet finished their work. They had no doubt, however, that something would soon be done in the matter.

Bailie M. W. MONTGOMERY seconded.

Treasurer STEVENSON remarked that he believed the gas accounts were the best stated accounts in connection with any department of the Corporation.

Mr. T. SUTHERLAND moved that the increased price for gas consumed through prepayment meters should be 3d., instead of 5d. as proposed. He thought that every citizen should pay the same price. They had 27,000 of those meters among the respectable poor in the city—people who, if they did not have prepayment meters, would not burn gas. It was no argument to say that these meters cost more. The Gas Committee got people to take up the meters for the sake of the sale of gas. It would cost nearly £1000 to alter the mechanism of the meters; and supposing they made the charge 2s. 8d., it would be about the same, because 2d. per 1000 cubic feet would be about £1400. All the sum which was involved would be about £4000. Give those people the benefit of improved light, and make their lives more comfortable. To raise the price by 5d. would not be doing justice.

Mr. W. MACLURE seconded. Why should they, he asked, charge people who paid in advance, more than people who took credit, and who sometimes did not pay at all? It was argued that it cost more to supply gas in that way. This was admitted; but the whole object was to encourage the consumption of gas, and prepayment meters did that. Instead of altering the meters, give those people gas at the same price; and possibly at the end of the year the cost of coal would have come down, and they would not then require to raise it.

Mr. W. F. ANDERSON did not see the necessity for altering the meters, because, if the price of coal came back, they might not require to alter them. He suggested that this recommendation should be taken back, in order to see if there were not a more business-like solution than was proposed.

Mr. A. MURRAY pointed out that, if the money were in the meter, it was an easy matter to give back part of it; but they would have a difficulty if they were to ask the people to pay 10 or 15 per cent. more than was in the meter. The question had been raised whether it was fair to charge these people 5d. extra, when ordinary consumers were only to be charged 3d. extra. As a matter of fact, what the prepayment consumers were to be charged was 3½d. extra, because they were only to be charged for eight, or probably seven, months in the year at the increased rate. For some time yet, they would only be paying 2s. 6d. He thought ½d. was a reasonable charge for the cost of altering meters. He considered that the proposal of the Committee was a fair and reasonable one, and ought to be carried through. The Engineer had calculated the matter, and the work could not be done without the increase proposed. It would be fair in the long run. The only consumers who would take the slightest disadvantage would be those who only came to use a meter after the extra charge was put on; but these would be very few, and next year by giving them discount they would be put in the same position as others.

Bailie GUEST was very sympathetic with the suggestion made; but the matter was threshed out in the Committee, and their experience was found to have been that the difference was not sufficient to cover the increased cost, because, first of all, a prepayment meter cost about 20 per cent. more than another meter, and then there was about 10 per cent. of extra cost in collecting the money. He asked Mr. Wilson why he had selected that particular figure; and he replied that it would work out better than any other. The meters would be altered so as to charge what would be likely to be the highest price which gas would ever probably reach in Glasgow; and they would not, consequently, have to alter them again.

Mr. SUTHERLAND, after the explanations which had been made, withdrew his amendment.

Mr. J. GRAY was sure they were all very distressed about the increase in the price of coal. He was told that for every increase of a shilling in the price of coal, the workman got 3d. per ton. He did not know where the difference went. He observed from the accounts that they were paying considerably more for collectors and account deliveries. He thought it was very hard for the Police Department, who paid annually about £60,000, that they should pay the same price as others, seeing there was no cost for collection or other extra charges. Why should they not get a discount? He would like also to know whether it would not be a good thing to charge the same rate in the outside burghs. There was another matter he would like also to bring before the Convener. As the gas undertaking was enabled to borrow money at a low rate from the Corporation, why should the ratepayers not get some benefit directly from it in aid of the rates? In Manchester last year, £60,000 was paid out of the gas profits to the rates; and in Birmingham, Belfast, and other places they obtained large assistance in the same way. He wished the Committee would apply themselves to these various questions, and bring up an answer, though not probably that day.

Bailie W. F. RUSSELL said that the greater proportion of the increase in the cost of coal went to the miners; but unfortunately the more the miners got, the less they worked. As to the cost of collectors, at the present moment a Sub-Committee had this under consideration; and he thought, seeing this was the case, these men should not have been increased about 18 per cent. It had been pointed out before that the collectors had to enter large establishments; and the people were really not encouraged to send their rates to the office, but to wait till they were called upon. It was explained that the increased cost of collection was the prepayment meters, because new men had to be taken to do this work. He thought they should try to encourage the public to send in their money, and that they should employ their own men to collect from prepayment meters. He was told that the man who was collecting gas-rates every day was not capable of collecting from prepayment meters. Why this should be so, he could not understand.

Bailie P. G. STEWART considered that they started prepayment meters far too soon. Their Law Agent had told them that they could not charge differential rates for gas. The real way to have kept down the price of coal was to have accepted the opinion of Mr. Foulis eight years ago. If they had done this, they would have been in a very different position to-day. He recommended the purchase of a coal pit. Coalmasters were reaping fortunes at the expense of the citizens of Glasgow. They should buy coal mines, have their own miners, and treat them generously, and not have the juggling with coal which they saw all over the country to-day.

Mr. CALDERWOOD pointed out that they had very large consumers in connection with railways and public works; and if the Corporation were to give discount to the Police Department, they would have to give discount to those large consumers too. As to the other remark of Mr. Gray, while the gas had been doing pretty well, if the Corporation wanted to add anything to the rates from the Gas Department, the Committee would require to consider the necessity of raising the price of gas. The increased cost of collection was accounted for by the prepayment meters. It was a very fair question for the Committee to consider whether they should issue notices to the consumers asking

them to forward their rates. This was a matter which was probably worth going into. They knew perfectly well that there was a very large section of the community who did not use gas; and this would require to be taken into account.

The accounts were then approved.

SOUTH METROPOLITAN GAS COMPANY'S ACCOUNTS.

[For the Half-Yearly Report, see p. 381.]

The following are the principal portions of the accounts of this Company for the six months ending June 30.

The first two statements relate, as usual, to the stock and loan capital. The former sets forth that the standard rate of 4 per cent. is payable on £6,011,224 and £418,671 (Act of 1901) of stock; while the latter shows that the loan capital, the rate of interest on which is 3 per cent., amounts to £1,798,994 and £96,451 (Act of 1901). The third statement is the capital account. It stands as follows: Amount received, £5 328,820; nominal amount added by conversion (less premium), £2,996,520—total, £8,325,340. The items of expenditure are as follows:—

Capital account to Dec. 31, 1906			£4,989,802 10 5
Expenditure during half year to June 30, 1907, viz.—			
New buildings and machinery in extension of works	£2,670 0 9		
New and additional mains and services	11,363 7 6		
New and additional meters	6,085 9 10		
New and additional stoves	2,576 0 8		
		22,694 18 9	
Total expenditure			£5,012,497 9 2
Balance			316,322 10 10
			£5,328,820 0 0
Nominal amount added by conversion, less premium			2,996,520 0 0
Total			£8,325,340 0 0

The following is the revenue account:—

Expenditure.

Manufacture of gas—			
Coal into store, including labour	£381,220 8 10		
Purification, including labour	15,245 2 8		
Salaries of Engineer and Officers at works	15,363 18 10		
Wages (carbonizing)	58,703 7 11		
Repairs and maintenance of works and plant, including labour, less £5856 11s. received for old materials	89,416 3 7		
		£550,954 1 10	
Co-partnership for twelve months to June 30, 1907	£45,590 9 0		
Less on account	18,000 0 0		
		27,590 9 0	
Distribution of gas—			
Repair, maintenance, and renewal of mains and service-pipes, including labour	£25,872 3 8		
Salaries and wages of officers, including rental clerks	17,874 13 3		
Repairing and renewals of meters, including labour	16,831 9 3		
Repairing and renewals of stoves, including labour	20,213 2 0		
Repairing and renewals of gas fittings, including labour	8,375 13 2		
		89,167 1 4	
Public lamps, including £20,104 2s. 3d. for labour and materials, less £16,410 11s. 9d. received for the same		3,693 10 6	
Rents, rates, and taxes—			
Rents payable	£883 19 9		
Rates and taxes	41,606 1 1		
		42,490 0 10	
Management—			
Directors' allowance	£2,531 18 0		
Salaries of Secretary, Accountant, and clerks	3,839 11 10		
Collectors { Ordinary	6,779 19 3		
Collectors { Slot meter	7,919 1 4		
Stationery and printing	2,781 15 10		
General charges	8,913 14 3		
Company's Auditors	112 10 0		
		32,878 10 6	
Law charges	£422 16 5		
Parliamentary charges	—		
		422 16 5	
Bad debts		1,376 8 1	
Pensions and officers and workmen's superannuation, sick, and accident funds		6,850 13 0	
Gas Referees and Official Auditor		251 14 1	
Leasehold renewal fund		500 0 0	
Total expenditure		£764,995 5 7	
Balance carried to net revenue account		219,591 3 0	
		£984,586 8 7	

Receipts.

Sale of gas—			
Lady-Day, at 2s. per 1000 feet	£364,302 18 6		
Midsummer, at 2s. per 1000 feet	255,848 12 10		
	£620,151 11 4		
Public lighting	15,099 1 3		
		£635,250 12 7	
Meters in use (322,336)—			
Company's meters at rent: Ordinary, 100,767; slot, 212,915	£35,387 5 5		
Company's stoves at rent: Ordinary, 74,220; slot, 176,755; fires, 21,387	28,452 15 0		
		63,840 0 5	
Residual products—			
Coke, less £16,198 15s. 1d. for cartage and labour	£177,390 1 6		
Breeze, less £5095 11s. 8d. for cartage and labour	6,717 13 10		
Tar and tar products	37,086 13 5		
Sulphate of ammonia	62,474 3 9		
		283,668 12 6	
Rents receivable		1,728 3 1	
Transfer fees		99 0 0	
Total receipts		£984,586 8 7	

The net revenue account shows a sum of £177,126 12s. 5d. applicable to dividend on the ordinary stock. Following this are the statements relating to the reserve, renewal, and insurance funds. They show that the balances on June 30 were as follows: Reserve fund, £181,028 renewal fund, £26,199; insurance fund, £108,313.

The statements furnishing manufacturing details are as follows:—

Statement of Coal.

In Store December 31, 1906.	Received During Half Year.	Carbonized During Half Year.	Used During Half Year.	In Store June 30, 1907.
Tons. 104,293	Tons. 584,741	Tons. 606,667	Tons. 843	Tons. 81,524

Statement of Residual Products.

Description.	In Store Dec. 31, 1906.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store June 30, 1907.
Coke—cwts.	266,156	7,505,912	1,970,397	5,591,402	210,269
Breeze—yards	22,162	130,303	32,931	103,535	15,999
Tar—gallons	1,012,742	5,792,590	5,822,495	44,498	938,339
Ammoniacal liquor—butts	11,764	213,075	215,921	..	8,918

Statement of Gas Made, Sold, &c.

Quantity Made.	Quantity Sold.		Total Quantity Accounted for.	Number of Public Lamps.
	Public Lights (estimated).	Private Lights (per Meter).		
Thousands. 6,574,985	Thousands. 157,691	Thousands. 6,249,014	Thousands. 6,493,429	23 278 incandes't 15 flat flame

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, £51,157; coke and breeze, £9097; tar, sulphate, and ammoniacal liquor, £41,635; and sundries, £286,433. The figures this time last year were: Coal, £38,452; coke and breeze, £6100; tar, sulphate, and ammoniacal liquor, £45,606; and sundries, £264,662. A sum of £61,021, workmen's bonuses and savings, has been deposited with the Company; and the total of the officers' superannuation and guarantee funds is £40,426. The figures last year were £66,071 and £34,692. The item, "Monazite sand suspense account," now stands at £9420, compared with £19,420 at the end of December, 1906.

SALFORD CORPORATION GAS SUPPLY.

The Past Year's Working.

In the "JOURNAL" for the 2nd ult., it was mentioned that the annual report of the Gas Committee of the Salford Corporation showed that there had been a considerable increase in the number of consumers in the twelve months ending the 31st of March last, and that the sales of gas had gone up 3·66 per cent. Another satisfactory feature of the year's working was the demand for gas appliances; the business in cooking-stoves having increased to a great extent, due, no doubt, to the large reductions made in the hiring rates about a year ago. The accounts accompanying the report show that the sale of gas and the rental of stoves produced a revenue of £175 848; residuals yielded £49,490; and the total receipts were £225,890. The expenditure on the manufacture of gas was £117,299; on distribution, £13,591; on management, £6565; rates and taxes came to £13,881; and the total expenditure was £155,499—leaving £70,391 to go to the profit and loss account. The amount standing to the credit of the account was £72,336. After paying £22,766 for interest and annuities, £15,309 in redemption of loans, and transferring £5000 and £5500 respectively to the works and plant and meters and stoves depreciation accounts, the net profits for the year, transferred to the district fund account, were £23,760. Under the supervision of Mr. W. W. Woodward, the Gas Engineer and Manager, the works and plant were maintained in a thoroughly efficient condition. The coal and cannel carbonized amounted to 162,784 tons; and the quantity of gas made to 1,663,415,000 cubic feet, of an average illuminating power equal to 19·25 standard candles—the parliamentary standard being 18 candles within the borough, and 17 candles as tested in the out-districts. The total receipts realized from residuals were not equal to the year 1905-6. Sulphate of ammonia and coke showed a diminution; but there was an increase in the receipts from the sales of tar.

The Purification of Spent Liquor from Sulphate Plant.—At the last meeting of the Brighouse Town Council, correspondence was submitted from Mr. John Radcliffe, of East Barnet, forwarding an amended offer to erect plant on his system to purify the spent liquor from the sulphate plant at the Mill Lane Gas-Works of the Corporation; and the offer was accepted. Mr. Radcliffe's system was described in the "JOURNAL" for the 2nd of October last (p. 22).

Inspection of Gas-Meters at Bristol.—In a minute which had been adopted by the Bristol City Council, the Sanitary and Improvement Committee stated that, having had a year's experience of the result of entrusting the duties of gas-meter examiner to the Deputy City Engineer, they were of opinion that the arrangement had worked well, and should be placed upon a permanent footing. The Committee therefore recommended that Mr. Steele be permanently appointed, during the pleasure of the Council, Inspector of Gas-Meters; and that he be paid, as from June last, a salary of £50 per annum for the performance of the duties of the office.

CROYDON GAS COMPANY.

Half-Yearly Report and Accounts.

In the report which the Directors will present at the half-yearly general meeting of the Croydon Gas Company next Friday, they state that the sales of gas in the six months ending the 30th of June exceeded those in the corresponding period of last year by 8 27 per cent.; while the number of consumers increased by 929, and that of stoves on hire by 1055. There were 58 hired stoves purchased by consumers. The Caterham works were closed for the manufacture of gas on the 6th of April. They are now being used as a depôt for the local sales of coke produced at Waddon; and negotiations are in progress for let ing a portion of the lands and buildings. The new section of scrubbing, washing, and purifying plant has been completed, and will be brought into use in the early autumn. A commencement has been made with the alteration and partial rebuilding of No. 2 retort-house, to increase its capacity and adapt it to modern methods of carbonization. In accordance with the provisions of the Croydon Gas Act, 1904, the price of gas in the Carshalton area of supply has been reduced, as from the 1st ult., to that charged in the Croydon area. In consequence of this, the holders of "C" stock will be entitled from that date to a dividend at the same rate as that upon the "B" stock.

The accounts accompanying the report show that the total revenue was £111,081, of which £80,011 was derived from the sale of gas, £7602 from the rental of meters and stoves, and £23,376 from the disposal of residuals. A sum of £54,708 was expended on manufacture and £15,650 on distribution; rents, rates, and taxes came to £4327; management cost £3879; and the total expenses were £82,911. For the corresponding period last year, the receipts were £101,471, and the expenses £76,710. The balance carried to the profit and loss account is £28,170, compared with £24,761; and the amount available for distribution is £28,511, against £24,381. The Directors recommend the payment of dividends at the rates of 14½, 11½, 10¾, 10, and 5 per cent. per annum, all less income-tax, on the various classes of stock. This will absorb £21,024, and leave a balance of £7487.

The statements relating to the working show that, under the supervision of Mr. J. W. Helps, the Engineer and General Manager, 39,278 tons of coal, 8 tons of cannel, and 495,484 gallons of oil were used during the half year in the manufacture of 613,575,000 cubic feet of gas, of which 580,862,800 cubic feet were sold and 588,846,300 cubic feet accounted for. The estimated quantities of residuals produced were: Coke, 23,692 tons; breeze, 5535 tons; tar, 482,052 gallons; ammoniacal liquor, 969,275 gallons—the make of sulphate being 329 tons.

YORK UNITED GASLIGHT COMPANY.

The report (dealing with the six months to June 30) submitted to the proprietors at the half-yearly meeting of the York United Gaslight Company last Thursday stated that the profit and loss account showed a balance of £9879; and out of this a dividend was recommended, less income-tax, at the rate of 4 per cent. per annum on the preference and consolidated ordinary stock, and the transfer of £1000 to the reserve fund. This would leave a surplus of £276 to be carried forward. During the half year 654 yards of additional mains were laid, 194 meters were fixed for new consumers, 411 cookers, 178 gas fires and boilers, and 1528 lights were fixed by the Company's own workmen in addition to those supplied by other gas-fitters, and there was a satisfactory increase in the quantity of gas sold by meter as compared with the corresponding half of last year.

In moving the adoption of the report and accounts, the Chairman (Mr. J. R. Hill, J.P.) said that, with one exception, there was nothing to which he need specially allude. The results of the half-year's working enabled them to pay the usual dividends, place £1000 to reserve, and carry forward a small balance; while the plant and premises had been maintained in satisfactory working order. They had renewed one section of retorts, and another section would need attention in the near future. Certain required alterations and improvements had been commenced at the head office; and the work was making satisfactory progress. The exceptional topic was the state of the coal market. A considerable rise had recently taken place in the price of coal; and there was great uncertainty as to the future. In addition to this, the railway companies had recently taken combined action, and given notice that they would not carry 21 cwt. to the ton, and charge the rate for a ton only, as they had been doing, but would charge carriage for the full weight. This charge was being strenuously resisted by the colliery proprietors, chambers of commerce, and other people interested; but if the railway companies succeeded in maintaining their position, it would mean an increase to the Company of some hundreds of pounds a year in the cost of their coal. Many gas undertakings had already found it necessary, owing to these causes, to raise the price of gas; and it might be that the York Company would have to take the matter into consideration.

The report was adopted, and the dividend recommended was declared.

WEST HAM GAS COMPANY.

Half-Yearly Report and Accounts.

The accounts for the six months ending the 30th of June last, to be presented at the half-yearly meeting of the West Ham Gas Company to-morrow, show that the total revenue was £146,331, compared with £131,991 for the corresponding period of last year; and that the expenditure was £114,975, against £101,134. The receipts from the sale of gas and the rental of meters and stoves, rose from £114,253 to £126,016; those from the sale of residuals, however, dropped from £20,291 to £17,726. The balance carried to the net revenue account is £31,356, against £30,857; and the amount available for distribution is £46,431, compared with £40,275. The former of the last two amounts, however, includes a sum of £19,076 brought forward; so that the net profit for the half year is £27,355, out of which the Directors recommend the payment of a dividend at the rate of 5 per cent. per annum on the preference stock, amounting to £4625; and of £5 2s. 6d. per cent. per annum on the consolidated ordinary stock, amounting to £21,675—making together, £26,300, and leaving £20,131 to be carried forward. The Directors point out in their report that, having regard to the price of gas during the period being dealt with, the sliding-scale would warrant the division of a further £528 13s. 4d. among the holders of ordinary stock; but in view of the importance of increasing the reserve fund, they recommend that this sum should be added to it. Up to the present, the greatly enhanced cost of coal has not seriously affected the Company; and consequently the Directors have not felt obliged to make any alteration in the price of gas. A large addition was made to the amount of rates and taxes for the past half year; the increase being from £6129 in the first half of 1906 to £9294. This is due to the fact that objections raised by the Directors to an excessive increase in the assessments in the West Ham Union so far back as 1904 have only recently been settled; and that the rates on the respective valuations from then to the present time could only now be fully brought into account. Applications for prepayment installations are still received in large numbers, and 4500 were supplied during the past six months.

The portions of the accounts relating to the manufacturing operations (which are in charge of Mr. John Clark, the Engineer and General Manager) in the past six months furnish the following particulars: Coal carbonized, 45,387 tons; oil used, 815,480 gallons; gas made, 859,945,000 cubic feet; gas sold, 833,988,000 cubic feet; gas accounted for, 841,988,000 cubic feet; coke produced, 27,183 tons; breeze, 5781 tons; tar, 656,831 gallons; sulphate, 495 tons.

A GOOD REPORT AT CAMBRIDGE.

The Directors' report which was adopted at the half-yearly meeting of the Cambridge University and Town Gaslight Company last Tuesday stated that the trading for the past six months had been satisfactory; and the payment of maximum dividends was recommended. The capital had been increased by the sale of £3000 of "C" stock at a very good price. The new purifier-house will, it is anticipated, be completed during the present half year. The Directors regretted to have to record the loss by death of the late Accountant, Mr. S. G. Wheaton, who had been connected with the Company for upwards of 36 years, and whose services were greatly esteemed. The vacancy has been filled by the appointment of Mr. G. W. Lawson, who was for some years Mr. Wheaton's principal assistant.

In the absence of the Chairman (Mr. E. H. Parker), the adoption of the report was moved by Mr. W. B. Redfern, the Vice-Chairman, who said he was very pleased to be able to call the shareholders' attention to a most satisfactory report. In all points, he thought he might congratulate the Company on steady and continued progress. The price of coal had risen, roughly, 2s. 6d. per ton; and this would make their coal bill something like £4000 more than it was before. Up to December, 1906, they consumed 15,351 tons of coal, and from December to June 16,906 tons—altogether 32,257 tons; so that they would see what an enormous increase this meant in their expenditure. The sale of coke would probably go some considerable way towards meeting the enormous outlay for coal; and this would at least extend up to Christmas of the present year. The gas paid for amounted to 328,447,000 cubic feet per annum, which was highly satisfactory. To meet the increased coal bill, the price of gas would require to be advanced about 3d.; but they hoped that the sale of coke and other residual products would enable them to keep the price as it was—for the present, at any rate. At the recent sale of stock, an average of £114 17s. 9d. per £100 was realized, which showed that the public had great faith in the Company. The increase of gas last year was 10,536,000 cubic feet, which pointed to the continued prosperity of the Company, in spite of any opposition they might meet with from the Electric Supply Company. He need not point out to the shareholders that a very large amount of their prosperity was attributable to the consumption of gas by people using cookers—for heating purposes, as well as lighting. Even for lighting, he found an increase among the consumers in the borough. Everything at the works was quite up-to-date, thanks to the Engineer and Manager (Mr. J. W. Auchterlonie), who was most energetic and careful with the alterations. He thought their works were something to be proud of. They were erecting new premises and repairing old ones; and everything was very satisfactory.

LIVERPOOL AND THE BIRKENHEAD WATER BILL.

At the meeting of the Water Committee of the Liverpool Corporation last Tuesday, reference was made to the above matter, and Colonel R. S. Porter said it would be the pleasure of the Committee to offer to the Chairman (Alderman Burgess) and to the city generally congratulations on the success which the efforts of Alderman Burgess and the Water Engineer (Mr. Joseph Parry) had met in London with regard to the Birkenhead Water Bill. Alderman Burgess, in acknowledgment, said that as the Bill had been reported by the House of Commons for third reading, it would be of interest that he should say something regarding the position the Liverpool Corporation adopted towards the measure. In the Bill as originally presented to Parliament, power was sought by Birkenhead to supply water within 20 miles of the Liverpool Corporation aqueduct; and this would have enabled Birkenhead to give such a supply right up to the Vyrnwy aqueduct, and in some cases beyond it. Such a power would have been very undesirable in the interests of Liverpool, and the 20 miles proposed was reduced to five in the House of Lords. But the decision of the House of Lords did not exclude places north of the Dee; and the Wirral Peninsula was left entirely open ground, in which both Corporations could compete without restriction. In view of Liverpool's agreement with Wallasey, it was necessary strongly to object to this; and the Corporation asked the Committee of the House of Commons to exclude from competition

places where agreements existed, especially Wallasey. In the year 1900 the Corporation entered into an agreement with the Wallasey Urban Council for the supply of water to their district; and the arrangement made was a fair and equitable one on both sides. The terms on which the supply was granted—6d. per 1000 gallons—were the lowest on which Liverpool supplied any water in bulk to local authorities; and Wallasey had now for some time past been taking a supply under the agreement. In view of this fact, it was thought reasonable that the Birkenhead Corporation should be precluded from supplying water in the district; and some evidence in support of this contention was given before the Committee of the House of Commons. The Committee decided that the Liverpool Corporation ought to be protected against unfair competition as regards the Wallasey area; and they introduced a clause into the Bill prohibiting Birkenhead from supplying water in that area for thirty years to come at a less price than was charged to consumers in Birkenhead. Though the provision did not in terms prohibit Birkenhead from supplying water to Wallasey, its effect would be to prevent unfair competition; and this was the danger Liverpool had to guard against. It was undesirable, in the interests of Wallasey as well as of Liverpool, that the agreement should be interfered with or tampered with; and as a result of the decision of the Committee, Liverpool might assume that the arrangement with Wallasey would now be of a permanent character. It was also necessary to oppose the Bill because it was very important for Wallasey that the water should continue to be delivered constantly to them, without any risk of interruption from the pipe-laying operations of the Birkenhead Corporation, as the Birkenhead pipe ran for two miles side by side with the Wallasey mains, and crossed them at five or six points. When it was considered that the Birkenhead Corporation had power to lay two or three lines of pipes, the importance of protection from any danger of interruption would be very apparent. Without a protecting clause, the Wallasey supply might frequently have been cut off while operations were going on; and the protection asked for was given by the Committee. With the alterations made, the Bill, as approved by Parliament, might be regarded as not unsatisfactory to the Liverpool Corporation.

Suggested Gas-Works Purchase at Nuneaton.—At the monthly meeting of the Nuneaton and Chilvers Coton Urban District Council, one of the members, in accordance with notice, introduced the question whether they should approach the Nuneaton Gas Company with the object of acquiring the concern. He explained that he should have left the matter over for the new Council to deal with, but for the fact that the time of the Council's option of purchase expired next year; and it was necessary that they should decide what they would do in the matter. In 1900, the gross revenue of the Company was £12 354; while for the last year it was £13,687. The profits in 1900 amounted to £2407, and last year to £3563. He suggested the appointment of a competent valuer to ascertain what would be a fair price to pay for the undertaking, and to see if some agreement could be arrived at with the Company for buying them out. Most of the members of the Council, he thought, would agree that they would be doing a good thing for the town by purchasing the undertaking at a reasonable figure; but he should not be in favour of the matter being settled by arbitration, as that would be a very expensive matter. The question was referred to the General Purposes Committee.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I am able this week to give a summary of the gas accounts of the Corporation of Glasgow, and a report of what took place in the Town Council when they were submitted. What appears in the other columns of this week's issue is of more value than anything I can write, because the statements, so far as taken from the documents, are official and authoritative, and so far as taken from the remarks of the speakers, are the statements of gentlemen who live for the whole year in perfect familiarity with the inner working of the undertaking. My feeling is that everything is so complete that there is nothing which I can write about, except to add my appreciation to that which I feel sure all will entertain as to the admirable manner in which the great undertaking is conducted. So great, indeed, has been the success of the Gas Department in recent years, that, although the Provan works are not yet three years old, it is already under consideration to extend them. Within the past three years the output of gas has increased by more than 500 million cubic feet. For the past twelve months the increase was over 250 million cubic feet. In gas matters the Corporation of Glasgow are really bearing out the City's motto—"Let Glasgow Flourish." There was a plea put forward on Thursday last for easier terms for users of prepayment meters. But it was not pressed; the mover of it being convinced, by the explanations offered, that the treatment of these consumers is fair and just. Perhaps in the experience of Glasgow there may be found a lesson for others, which is to rate the meters high, and, in the event of the price of gas coming down, to return a portion of the drawings to the consumers. It is much more agreeable to the consumers to get something back than to be asked to pay something extra, the alternative being that the gas undertaking should go on altering the meters with every change in the price of gas. One member—an adept financier, too—had the temerity to suggest that the gas profits should contribute something in aid of the rates. The proposal is not likely to receive much consideration. The commonsense of the Corporation has been all along against such a policy; and the time is past for the initiation of it, because there is now such a large proportion of the well-to-do class who do not burn gas, and to have the poorer classes, who still use gas almost exclusively, relieving the upper classes of their share of assessment, would be intolerable. The only other criticisms offered were of a trifling nature.

In the Paisley Town Council on Monday, Treasurer Macbean submitted his annual statement regarding the financial position of the burgh. They were about to obtain a new Provisional Order, under which they would have power, among other things, to impose a guarantee rate for gas and electricity purposes; and there would also be new regulations for the sinking fund in connection with the Water Trust, which would liquidate the debt in fifty-four years. The Gas Department had had, as on former occasions, a most successful year. The surplus was £6044, of which amount £4800 had been voted to various trusts in relief of the rates. They had produced 10,331 cubic feet of gas per ton of coal; while the loss due to condensation and leakage was only 6·65 per cent. He regretted, however, that they would require to make an increase of 1d. in the charge for gas; but this, as was well understood, was due entirely to the increase in the

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 376.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Feb. 28	14	Bournemouth Gas and Water 10 p.c.	27½—28½	..	4 18 3
51,810	10	,,	7	Do. B 7 p.c.	16½—17	..	4 2 4
53,200	10	,,	6	Do. Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	,,	12½	Brentford Consolidated	250—255	..	4 18 1
300,000	,,	,,	9½	Do. New	188—193	..	4 18 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	117—122	..	4 2 0
206,250	,,	June 13	4	Do. 4 p.c. Deb.	103—105	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41—43	..	4 13 0
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c.	119—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c.	90—93	..	4 16 9
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾—11¼	−¼	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	25—27	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord.	109—111	..	4 10 1
1,443,280	Stk.	,,	5 2/10	Commercial 4 p.c Stk.	105—108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	102—105	..	4 15 3
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk.	123—125	..	4 8 0
55,000	,,	Jan.	4	Do. Deb. Stk.	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd.	23—24*	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid	17½—18½*	..	4 17 4
15,182,590	Stk.	Feb. 14	4 4/10	Gaslight and Coke 4 p.c. Ord.	94—96	−1	4 11 7
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	88—90	..	3 17 9
3,799,735	,,	,,	4	Do. 4 p.c. Con. Pref.	104—107	..	3 14 9
4,193,975	,,	June 13	3	Do. 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	173—176	..	4 10 11
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A	221—223	..	4 9 8
718,100	,,	,,	7	Do. B	164—165	..	4 4 10
144,140	Stk.	Feb. 14	7⅝	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Feb. 28	4⅝	Newc'tle & G'tesb'd Con.	108—109	..	4 4 10
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	93½—94½	..	3 13 8
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord.	6¾—7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref.	4½—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	12¾—13¼	..	6 0 9
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	246—248	+1	4 0 8
209,984	,,	,,	10	Do. B	246—248	+1	4 0 8
523,500	,,	,,	10	Do. C	246—248	+1	4 0 8
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,350,000	Stk.	Feb. 14	5½	South Met., 4 p.c. Ord.	120—122	..	4 10 2
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	82—84	..	3 11 5
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159—161	..	4 19 5
605,000	Stk.	Feb. 28	5½	S'th Suburb'n Ord. 5 p.c	117—121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Feb. 28	6½	Tottenham and Edmonton A 5 p.c.	123—126	..	5 3 2
398,940	,,	,,	5	Do. B 3½ p.c.	100—103	..	4 17 1
137,500	,,	June 27	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 15 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c.	—	..	
255,636	,,	,,	6½	Do. B 3½ p.c.	131—136	..	4 15 7
75,000	,,	,,	5⅝	Do. C 3½ p.c.	—	..	—
79,416	,,	June 27	3	Do. 3 p.c. Deb. Stk	77—80	..	3 15 0
845,872	,,	Feb. 28	5⅛	West Ham 5 p.c. Ord.	102—105	..	4 17 7
165,000	,,	,,	5	Do. 5 p.c. Pref.	120—123	..	4 1 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div"

price of coal. The increase was agreed to; and it was remitted to a Committee to consider the charge for gas for motive power.

The Perth Town Council on Monday held a special meeting to consider the report of the Auditor upon the gas accounts for the past year. The Auditor, in a note to his report, desired the Council to state in the accounts an approximate sum to cover gas consumed between the time of the previous survey—Feb. 11—and May 15. Lord Provost Cuthbert moved that this be done, and that the sum to be entered be £1535, to be allocated as follows: To gas-stove maintenance, £850; to the common good of the burgh, £250; as a debit balance of the gas accounts, £350; and to be carried forward, £85. The Auditor, he said, had repeatedly called attention to this matter; and the Town Council, if they agreed to his motion, would be only following the practice which had been adopted in other places. The principle was a sound one, and ought to have been started when the gas undertaking was taken over by the Corporation. Mr. Paton moved that no sum be so entered in the accounts. If, he said, the motion were carried, it would practically mean their putting fourteen months' revenue into a year's account. The Auditor had called attention to the matter once or twice; but he had always explained that the money should be used in payment of debt, instead of for revenue purposes. The motion was carried by sixteen votes to six.

The following statement appears in the "Dumfries Standard" this week: "A gentleman resident in Dumfries some ten days ago called our attention to the charges made for the hire of gas-cookers in Dumfries, compared with the sums charged in Kilmarnock and some other towns. Here, 10s. per annum is charged by the Town Council for the use of a No. 3 "Main" cooker; in Kilmarnock the rent is only 3s. 8d. For No. 2 size, the charge in Dumfries is 8s. 6d.; in Kilmarnock, 3s. 2d. For No. 1 size, 6s. 6d. is charged in Dumfries; 2s. 8d. in Kilmarnock. We understand that the sums levied in Dumfries little more than pay the cost of the cookers to the Council; the accounts for past years showing profits of only 4 per cent. The Council have to keep the hired-out cookers in repair, and to replace them when worn out; and their customers have the option of purchasing them at any time, at the same price at which they are bought by the Council—payments which have been made by way of rent being reckoned part price. The Gas Committee, having had the matter brought to their notice, are making inquiries regarding the experience of other towns, and will readily adopt any suggestions which would reduce the cost to consumers, without entailing loss on the burgh. It is possible that in other towns cookers are provided at less than cost price, in order to encourage the consumption of gas; but this is a policy which has not been adopted in Dumfries. If resorted to, it might have far-reaching effects, for why, on the same principle, should the Council not provide gas-engines free, and even the gas-fittings of a private house? There are now, we understand, about 500 cookers in use in the town. Most of them are the property of the householders."

The annual general meeting of the Crieff Gas Company, Limited, was held on Wednesday last—Dr. T. N. Meikle in the chair. Out of the profits of £1250 for the year, it was resolved to pay a dividend of 7½ per cent., and to place £363 to the reserve fund. The consumption of gas increased during the year to the extent of 6 per cent. Owing to the greater cost of coal—amounting to £600 in the year—it was resolved to raise the price of gas from 3s. 9d. to 4s. 2d. per 1000 cubic feet.

Improved Street Lighting in Fulham.

At the meeting of the London County Council last Tuesday, the Finance Committee reported that the Fulham Metropolitan Borough Council proposed to enter into an agreement with the Gaslight and Coke Company, under which the Company would provide and fix new, and alter existing, gas lamps and fittings in certain streets in the borough, and the Council were to pay for the work by twenty quarterly instalments. It was proposed to deal with 1026 lanterns and 1038 burners; and the payments made to the Company would amount to £1621. This arrangement was held by the District Auditor to require the sanction of the County Council as though it were an ordinary loan. The Borough Council had accordingly asked for sanction to the borrowing of the sum mentioned, and also of a further amount of £26 5s., the estimated cost of certain incidental paving work. The Committee were advised that the sum proposed to be paid to the Company was reasonable, and they thought that sanction to the borrowing of the amount should be given, but that the further £26 5s. applied for should not be sanctioned. They therefore recommended accordingly; and this was agreed to.

South Staffordshire Co-Operation Scheme.—By invitation of the Mayor of Dudley (Mr. F. W. Cook) a meeting of municipal representatives from neighbouring places was recently held. The attendance included the Deputy-Mayor of Birmingham, the Deputy-Mayor of Wolverhampton, the Deputy-Mayor and Deputy Town Clerk of West Bromwich, the Mayor and Deputy Town Clerk of Smethwick, the Mayor and Town Clerk of Wednesbury, and the Town Clerk of Dudley. A letter of apology from the Mayor and Town Clerk of Walsall explained their inability to attend on account of a Council meeting. Mr. Cook took the chair, and said the Black Country was a peculiar place, consisting practically of one great town, connected by tramways, canals, and railways, with practically the same industries, the same difficulties, and the same monopolies to fight. Yet they found this district divided among a great number of large and small authorities, with very little intercourse between them, and consequently at a disadvantage when dealing with any great monopoly. If united by a standing conference, they could, to their mutual advantage, take united action with regard to such questions as intercommunication, health, sewage, education, &c., and also the question of dealing with power companies and the supply of electricity, gas, and water. In matters in which large areas were affected, they could make joint representations to the Local Government Board; and the voice of a joint conference would be powerful in making representations to Parliament. It was agreed to call a conference of all the local authorities in the district bounded by, and including, Stourbridge, Walsall, Birmingham, and Wolverhampton—the meeting to be held in Birmingham in October.

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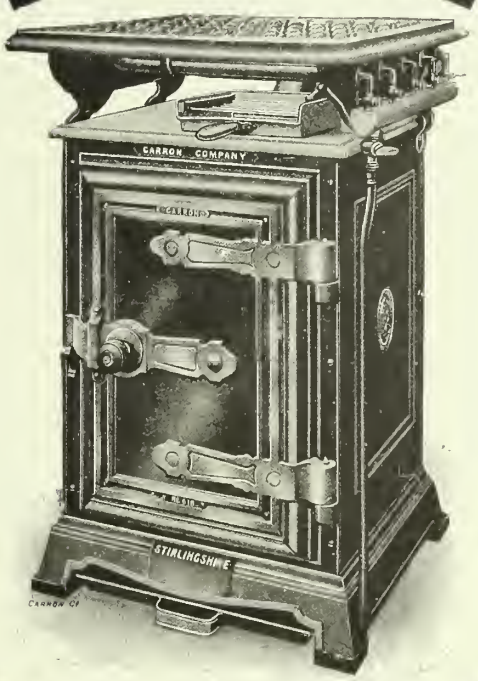

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 2.

Sulphate of Ammonia.

The market has been very quiet at all points; and, although quotations remain without material alteration, the tendency is in favour of buyers. The closing quotations are £11 15s. per ton f.o.b. Hull, £11 16s. 3d. to £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has been a fair amount of inquiry for delivery over the autumn months; and business has been done at the parity of £12 per ton, delivered free on board. For delivery over the spring months of next year, makers still quote £12 2s. 6d. to £12 5s. per ton, according to port; but these prices are not being paid.

Nitrate of Soda.

This article is quiet at 11s. 1½d. to 11s. 4½d. per cwt., according to quality, on spot.

LONDON, *Aug.* 3.

Tar Products.

There appears to be very little business doing, doubtless owing to the slack season and to so many of the principals being away holiday making. Pitch still remains quiet; and no business is reported for either prompt or forward delivery. Continental consumers evidently intend to await the course of events. Creosote continues firm; and manufacturers maintain their prices. Carbolic acid is still in the same position. Manufacturers will not reduce their prices; while consumers do not seem at all anxious to buy. No alteration is reported in crystals. There is no change in 90 per cent. benzol; and the market is quiet for both prompt and forward delivery. There appears to be no business in 50-90 per cent. benzol and toluol. Solvent naphtha maintains its position, both in the North and in London.

The average values during the week were: Tar, 15s. 6d. to 20s. Pitch, London, 26s. nominal; east coast, 25s. to 25s. 6d.; west coast, 23s. 9d. to 24s. 6d. Benzol, 90 per cent., 7½d. to 8½d.; 50-90 per cent., 8¼d. to 9¼d. Toluol, 10½d. to 11¼d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. to 1s. 2¼d.; heavy naphtha, 1s. 1½d. to 1s. 3½d. Creosote, London, 2⅞d. to 3d.; North, 2½d. to 2¾d. Heavy oils, 3d. to 3¼d. Carbolic acid, 60 per cent., 1s. 7½d. to 1s. 7¾d. Naphthalene, £6 to £12.; salts, 37s. 6d. to 42s. 6d. Anthracene, "A" quality, 1½d. to 1¾d.

Sulphate of Ammonia.

This article remains in exactly the same position as last week, and prices are £12 2s. 6d. to £12 5s. for the principal London Gas Companies' makes for forward, and £12 1s. 3d. for prompt. Ordinary London price is £11 13s. 9d. to £11 15s., Leith £12 to £12 2s. 6d., Liverpool £11 16s. 3d. to £11 17s. 6d., and Hull £11 15s.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The Lancashire colliery proprietors are determined to resist the advance in railway rates on coal, coke, &c.; and on Tuesday a more general meeting of coal owners and merchants was held at the Manchester Coal Exchange, when the subject was further considered. Letters from the London Coal Merchants' Association, Wigan, and Bradford on the subject were read. After speeches antagonistic to the action of the Railway Companies, it was resolved: "That this meeting strongly protests against the increase in charges for carriage of coal, coke, breeze, and patent fuel brought about by abolishing the system in force up to June 30, 1907; being of opinion that such alterations will lead to endless friction between collieries, traders, and railway companies, and consequent litigation through short weights." The coal trade continues satisfactory. There is no change to report in the average quotations for all classes of coal. Coalowners were never in a better position, apart from railway troubles, than now.

Northern Coal Trade.

There is a strong demand for coal generally in the North-east; and as the holiday affects the output, it is probable that it will continue for some time. In the steam coal trade, the requirements are very heavy at all the shipping ports; and the collieries, having booked a large part of their output for some weeks to come, are now able to ask higher prices for any surplus for sale. Best Northumbrian steam coals are 16s. per ton f.o.b., second-class steams are from 14s. 9d. to 15s. 6d., and steam smalls from about 10s. to 10s. 6d. In the gas-coal trade, the demand is a little heavier locally, and will probably increase more sharply now that the days are beginning to shorten appreciably. Durham gas coals are quoted from about 13s. 6d. to 14s. 9d. per ton f.o.b., and are steady at these figures, with slightly higher values for special classes of fuel. In contracts, there is not much to report this week; but there have been some sales for delivery over next year, with more inquiries. The prices are put for such sales as 13s. 6d. to 13s. 9d. for second class. The pressure, however, seems to be for delivery for winter use. In the coke trade, there is activity. Gas coke is dearer for export, though irregularly so. Good gas coke is quoted from about 17s. 6d. to 18s. 6d. per ton f.o.b. in the Tyne, with a strong demand.

Scotch Coal Trade.

The market is still active and strong. Supplies are not so plentiful as purchasers would like to see them; and consequently what coal is got is being readily disposed of. The foreign demand is still very large. Prices in the retail trade are being advanced by 1s. per ton. The prices quoted, per ton, f.o.b. Glasgow, are: Ell, 13s. to 14s. 6d.; splint, 14s. to 14s. 3d.; and steam, 12s. 6d. to 12s. 9d. The shipments for the week amounted to 224,222 tons—an increase upon the previous week of 41,347 tons; but a decrease upon the corresponding week of 10,857 tons. For the year to date, the total shipments have been 8,114,836 tons—an increase upon the corresponding period of 373,744 tons.

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Congestion at the Hull and Grimsby Docks.

In an article dealing with the congestion existing at the Hull and Grimsby Docks, the "Yorkshire Post" remarks, taking into consideration the number of vessels stowed away in the different docks, and the number of large boats waiting outside in the river, if no further business came to Hull for the next three weeks, and no further steamers were to arrive, the Railway and Dock Companies would have enough to do to clear off the work in hand. The situation is rendered all the more galling to shippers by the existence of a system of preferential berths. "It is," the writer says, "a common thing to see little London boats, and others on short trades, to which special favour has been shown, coming straight into dock, quietly getting their cargoes of coal and slipping out to sea again, while the big steamers held up in the river are looking on. The grievance is a real one, and must lead to litigation. The Hull Exporters' Association complain very strongly about the preference which is being given to certain of the London gas-coal steamers, and also to the steamers loading Denaby coal; and it is an open secret that legal action is going to be taken against the Hull and Barnsley Railway Company for giving what is alleged to be undue loading preference to these interests. It is stated that the preference given the Denaby Company in the use of the hoists is granted under a long-standing agreement with the Hull and Barnsley Railway Company, who own the Alexandra Dock; but the preference extended to the London gas-coal interest appears to have no such excuse, and it is important that, in the interests of the trade generally, this question of preference by the Dock Companies should be settled once and for all. Very wide and far-reaching are the issues involved in this matter, because, for instance, if it is held to be illegal for the Hull and Barnsley to give preference at their hoists to any particular line of steamers, it would also be illegal on the part of the North-Eastern Railway Company to give preference at their docks to the steamers, for instance, which they own jointly with Messrs. Wilson, Sons, and Co., or to the Hull and Netherlands steamers, in which that Company is largely or entirely interested. Therefore, any decision estopping the Hull and Barnsley Company from giving a preference at their dock, would upset the preferential arrangements at the North-Eastern Company's docks; and each ship would then have to take its proper turn." The same condition of affairs is reported from Goole.

Price of Gas in French Towns.

In a report recently prepared by the Municipal Council of Langres (Haute Marne), the prices charged for gas in various towns in the East of France were given. Converted into English equivalents per 1000 cubic feet, they are as follows: Dijon—Public lighting, 1s. 4·2d.; municipal buildings, 2s. 5·7d.; private consumers, 3s. 7·2d.; engines, &c., 2s. 8·4d. Vesoul—Private consumers, 6s. 9d.; heating and motive power, 5s. 2d. (these prices falling after this year to 6s. 3·6d. and 4s. 6d.). Chaumont—Public lighting, 5s. 4·8d.; municipal buildings, 5s. 10·2d.; private consumers, 5s. 10·2d.; heating and motive power, 5s. 2d. Epinal—Public lighting, 3s. 4·5d.; municipal buildings, 4s. 11·4d. until 1910, and 4s. 6d. afterwards; private lighting and heating, 5s. 7·5d.; motive power, 4s. 11·4d. until 1910, and 4s. 6d. later. Nancy—Public lighting and municipal buildings, 2s. 3d.; private consumption for all purposes, 4s. Troyes—Public lighting, 2s. 3d.; municipal buildings and private consumption for all purposes, 4s. 9·7d.

Ilkeston Gas-Works Results.

Speaking at the quarterly meeting of the Ilkeston Town Council, Alderman Beardsley, the Chairman of the Gas Committee, said the gas made during the past year amounted to 103,716,400 cubic feet, which was an increase of 4,130,700 feet; and the resulting income had advanced from £11,678 to £12,304. The return for residuals was £4057, against £3993—making a total increase of about £700. The cost of manufacture, mainly owing to the larger tonnage of coal used, had advanced from £7153 to £7316. Distribution expenses had returned to the normal, and stood at £887. Nearly £200 had been placed to the repair and replacement of cookers; and, with rates and taxes and management at the usual figure, they had a total expenditure of £10,179, against £10,040; leaving a gross balance of £6368 6s. 9d., compared with £6168 for the previous year. This balance would enable them to make the necessary larger allowances for depreciation and sinking fund charges, and, with the addition of £143 from the suspense account, provide for the ordinary contribution to the rates. The number of consumers was 4778, of whom 3614 had prepayment meters—or an advance of 340 on the preceding year. There were 1623 cookers now in use—an increase of 153. The number of orders received at the office from customers had exceeded 3700, most of which were dealt with the same day as they were received. The sum of £18,105 had been handed over to the relief of the rates since the acquisition of the gas-works by the town. The total amount borrowed on the works was £73,640, which had been reduced to an outstanding balance of £58,599.

Death from Gas Poisoning.—At an inquest held before the Manchester City Coroner on Monday of last week, it transpired that Florence Philipps, the 21-year-old daughter of a Manchester shipping merchant, residing in Wilbraham Road, had suffered for the last two years from Bright's disease, and was occasionally depressed. On the 26th ult., she was left in charge of the house while the family were away. When her mother and sister returned in the evening, Florence Philipps was found dead on the scullery floor from the inhalation of coal gas. Two of the taps of the gas-stove were turned full on. The doctors called in agreed that death was from inhaling gas, but considered it possible that deceased might have been intending to use the stove, and before applying a light fell in a fit, and so met her death. The Jury returned a verdict of "Death from misadventure."

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Gas and Electricity Works Inspection at Rochdale.—Members of the Rochdale Gas and Electricity Committee, as the result of a suggestion made in the Town Council, lately paid a visit to the gas and electric works. They were conducted over the former by the Manager, Mr. T. B. Ball; and under his able guidance a most instructive time was spent. Afterwards the party inspected the electricity works in charge of the Manager, Mr. C. C. Atchison, who explained the plant in detail. Returning to the gas-works, the visitors were entertained to tea in the Committee-room by the Chairman (Mr. Walker). Here they were joined by ex-Alderman W. J. Petrie, who for many years was Chairman of the Gas Committee.

A Councillor and his Gas Bill.—Among the defaulters summoned at the Dewsbury Borough Court last week, was Councillor Fred Wilby, who, the collector stated, owed £1 10s. 9d. for gas supplied. Defendant said that, as regarded £1 8s. 11d., he had no objection to offer; but he protested strongly against the balance of the amount. He then produced a copy of the Corporation's Improvement Act, 1884, and pointed out that they were not entitled to recover—the account being beyond the date (twelve months) within which they were entitled to recover. The collector submitted that the twelve months should be calculated from the time when he made the demand for payment. The Bench, after having a consultation with their Clerk, decided to dismiss the case.

Dublin Exhibition Water Supply Cut Off.—In consequence of a dispute, the Dublin Corporation last week cut off the supply of water which had been laid on to the exhibition as a provision in case of fire. Two lines of 6-inch pipes were put down; and on these about sixty hydrants were fixed. The charge for the whole time during which the exhibition remained open was arranged to be £2; the one condition being that the water should not be used for any purpose except in case of fire. The Executive of the exhibition, it is stated, gave the undertaking required; but the Corporation officials allege that the condition has been violated, and that by attaching hoses to the hydrants the water which was intended only for fire has been used for the general purposes of the exhibition, including the water chute.

Water Conservation in Istria.—It would seem from a recent number of the "Neue Freie Presse" that an English Syndicate is about to undertake the construction of large reservoirs to provide water for drinking and irrigation purposes in Istria. According to a paragraph in "The Times" Engineering Supplement, an engineer from Vienna (Herr Schwarz) has completed the requisite surveys, and it is proposed in the first instance to carry out two mountain reservoirs—the smaller one to contain 77 million gallons, for drinking water, and the larger, with a capacity of 275 million gallons, for irrigation purposes. These reservoirs will be situated in the province of Parenzo at Sterna, in the commune of Crisiznano, and the estimated cost is for this first part of the work £166,666, while the cost of the entire scheme will amount to about £1,460,000.

London Borough Councils and Electric Lighting.—At the meeting of the London County Council last Tuesday, Mr. Ward, on the reception of the report of the Finance Committee, drew the attention of the Council to the money being spent by the Borough Councils on electric lighting. He pointed out that there were on the paper no less than three requests for loans for this purpose—the Hackney Council asking for £14,000, the Hammersmith Council for £11,145, and the Poplar Council for £5600. The County Council did not propose to promote any further legislation on the subject, or to spend any money in obtaining a bulk supply, with the result that the money was being spent by the Borough Councils. It was obvious that the distribution of electricity through small stations was more costly than if it were supplied in bulk by a large central station. The money of the ratepayers in London was really being wasted.

Explosions in Street-Boxes.—At the meeting of the Wandsworth Borough Council last Wednesday, a letter was received from the London County Council, in reply to a communication written by the Borough Council, at the instance of the Wandsworth and Putney Gas Company, on the subject of explosions caused by accumulations of gas in telephone, electric light, &c., street-boxes. The London County Council pointed out that they had approved the construction of the Electric Supply Company's boxes in the borough subject to their being built of 9-inch brickwork in cement and 6-inch concrete flooring, with ½-inch asphalte on the floor, to the outside brickwork being rendered all over with a thick coating of asphalte, and to adequate means being taken to prevent the accumulation of gas in the boxes and conduits. It was added that the County Council Committee were of opinion that the Gas Company should be urged to adopt measures to prevent leakage of gas from their mains. No action was taken upon the communication.

Effect of the Removal of the Coal-Tax.—At the half-yearly meeting of the Great Eastern Railway Company last Tuesday, the Chairman (Lord Claud Hamilton), in the course of his speech in moving the adoption of the report, referred to the effect on the Company of the removal of the coal-tax. He said they were faced by an increased expenditure of £44,000 on coal for the past half year, which was a very serious matter. The increase in the price of coal, which pressed so hard upon railway companies and upon every commercial undertaking dependent upon coal, was mainly due to the removal by the Government of the export duty. This had resulted in an extraordinary demand for coal on the part of foreign Governments and of foreign manufacturers; and colliery proprietors found it more profitable to send their coal abroad than to sell it in this country. Thus, while we were calmly depleting one of the great capital assets of our own country, the whole manufacturing industry was suffering in order that colliery proprietors and miners might grow rich at their expense. This was not the only evil. English coal was being largely used by foreign manufacturers to compete with us in our own markets; and, owing to their cheaper cost of production, they would in a short time be underselling our own manufacturers. This was not good for trade, nor was it good for railways; and he feared the effect would shortly be to arrest that commercial development which had recently taken place in the manufacturing districts of the country.

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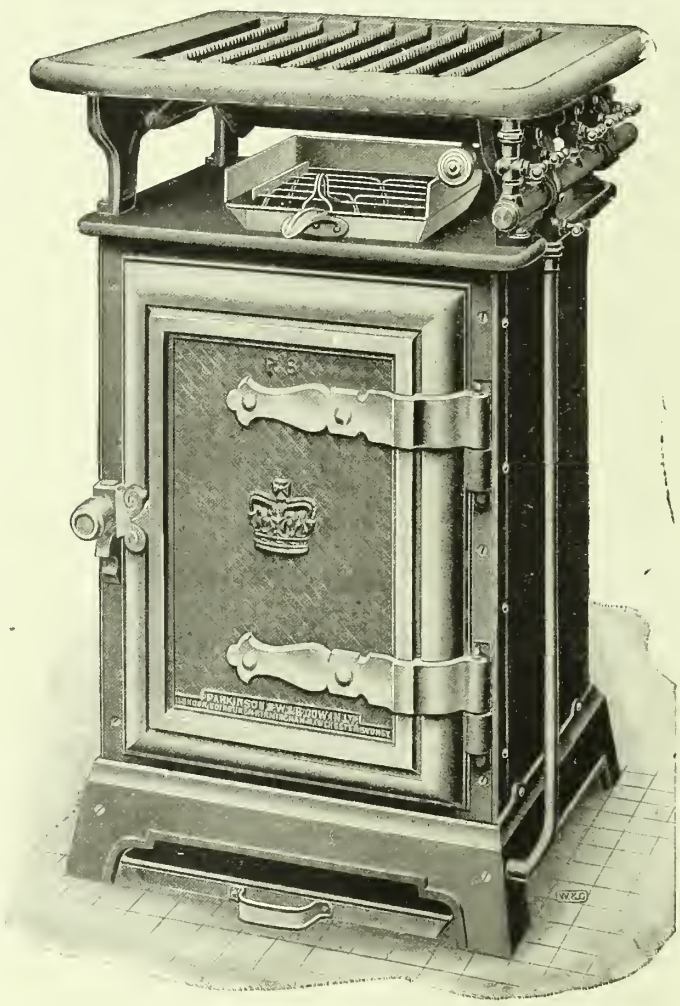

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Under the heading "Tour and Travel," Mr. Thomas Newbigging recently gave in the "Manchester City News" an interesting account of New Lanark and the Falls of Clyde.

The Halifax Gas Committee have entered into contracts for 36,000 tons of coal, which, together with the stocks in hand, will be a sufficient supply to the end of June next year. Compared with last year, there is an advance of between 2s. 3d. and 2s. 6d. a ton in the price of the new contracts. In their estimates for the year, the Committee allowed for an increase of 2s. 6d. per ton.

Last Friday night a gas explosion occurred in a tenement house in Garngad Road, Glasgow, the windows being blown out and the walls cracked. Six of the inmates were removed to the infirmary suffering mostly from shock. Some pedestrians were thrown to the ground by the explosion and stunned. James Slavin on returning to the tenement smelt gas, and searched for the escape with a lighted candle. He was badly burnt, and lies in the Infirmary. Seven families are homeless as the result of the explosion.

The Chairman of the Finance Committee of the St. Pancras Borough Council, in his annual report, gives in detail the amounts paid for gas for street lighting during the past fourteen years, and those paid for electric current and the maintenance of street-lamps since the commencement of the supply. It was, he writes, important to observe that now the borough is well illuminated by electricity the expenditure for gas lighting has been very much reduced during the last fourteen years. To give an instance, he mentions that while the expenditure on gas lighting in 1897 cost out of the rates £13,461, and the expenditure on electric lighting cost £3827, making a total of £17,288, ten years later the cost was £6946 for gas lighting and £15,690 for electric lighting; making a total of £22,636—showing the increase for the present year of £5348, or a rate of ¾d. in the pound. On the other hand, profits out of the electricity undertaking to the amount of £18,000 have been transferred in aid of the rates during the past ten years, including £8000 since the charge for current to the public lamps was reduced; but against this it has cost £35,000 more for public lighting during the past seven years than for the previous similar period.

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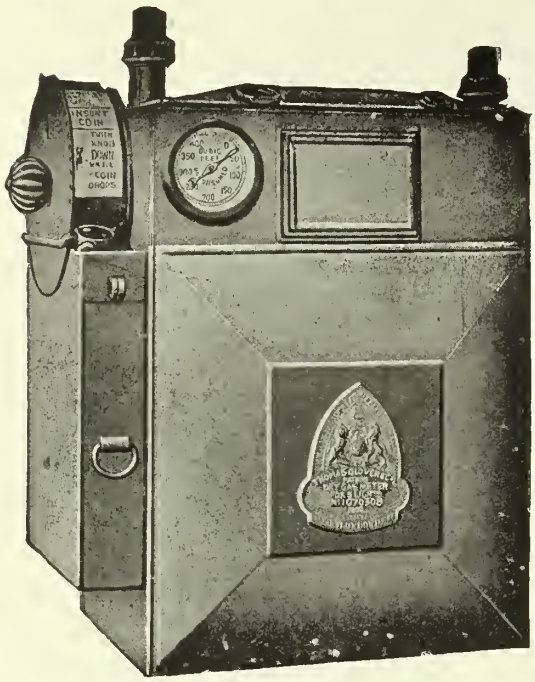

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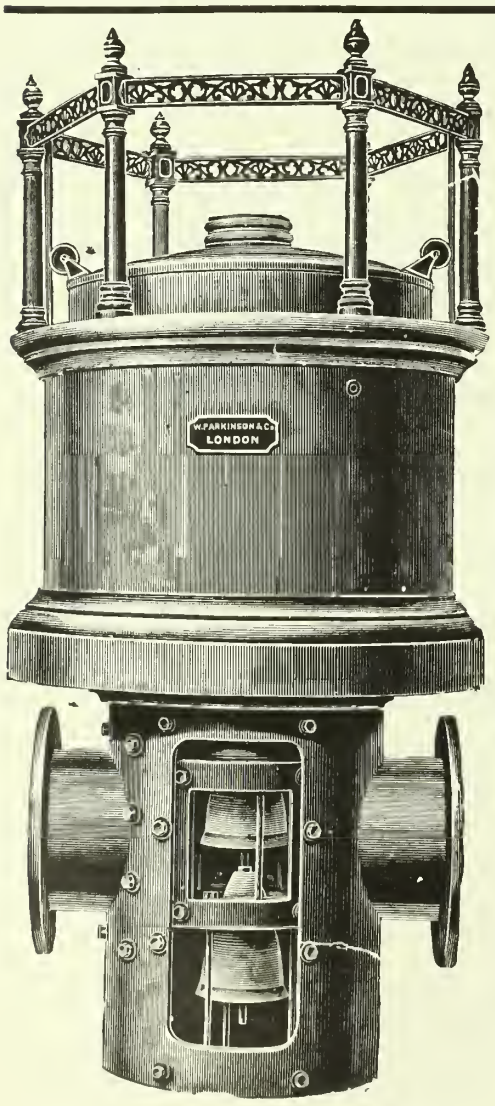

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VOL. XCIX., No. 2309.—TUESDAY, AUGUST 13, 1907.

EDITORIAL NOTES—GAS, &c.

Current Experiences and Methods of Procedure.

DURING the past week, three of the important Gas Companies operating in extra-Metropolitan areas held their meetings; and at each the proprietors manifested quite a stoical demeanour towards the heavy cloud of advanced cost for raw material that hangs over the gas industry, in common with others. We do not desire in any way to make light of the position; for it must be fully realized that, unlike most other industries, coal is at the root of the entire gas business. It is, where water gas is not employed, the sole raw material required in manufacture. But while this is so, and the industry is hardly hit, proprietors and consumers are not loud in complaint. It cannot, however, escape notice that the reports of the meetings of other industrial enterprises, the great activity in trade notwithstanding, are filled with lamentations regarding declining profits in proportion to the business done—that is to say, that, per unit of business, the profits realized are now lower than formerly. Severe competition on the one hand, and the higher values of raw materials on the other, are doing their work; and in those industries the advantages of competition—the primary regulator of prices—are for the present being reaped entirely by the consumers, without the activity in trade producing additional benefit for those engaged in it. There is but one end to this kind of thing, and that is combination, under the cast-iron laws of which the consumers, as a rule, suffer, if there is not statutory regulation. Most of the industries referred to are what may be termed one-product industries; and over them the gas industry has, as Mr. Corbet Woodall reminds in a few remarks at the meeting of the Croydon Gas Company, the benefit of a great number and variation of products and divers uses for the staple product. The result, so common experience tells us, is that when one product is depressed others render better aid. Indeed, the industry during the past quarter of a century has been marked by marvellous vitality and procreant power; and never more so than at the present time. And yet its position has only been maintained by renouncing high profits, and resting content with, for an industrial enterprise, a modest return on the capital invested. All that the industry has done for capital through its expansion has been to give greater scope for safe investment—nothing more. But in safety there is an infinity of value; and the lesson to be derived from contrasting our industry with others is that a broad base is the safest of all foundations. Therefore, the greater the number of outlets for products, the greater the number of applications, the stronger the industry. We have not yet exhausted the possibilities before the industry; but they will not unaided develop themselves.

The coal question naturally outweighed all others at the meetings of the South Suburban, the Croydon, and the Tottenham Companies. The excellent state of the accounts of these Companies for the past six months must not be taken as a fair gauge of what the financial position in the next twelve months will be under the burden, in each case, of the several thousand pounds excess in the cost of coal. Those who so take them may find, before many months have lapsed, that they have accepted untrustworthy guides. Throughout the past six months, coke has followed coal in the upward direction; but coincidently the Companies have been working out their contracts for coal at lower prices than those now obtaining. From coke they have realized something in the region of 1s. extra per ton of coal carbonized, to set against the cost of coal at for most part the lower prices of last year, and in small part at the higher prices now ruling. This happy condition of things ceases altogether now; and, as Sir George Livesey at the South Suburban meeting, Mr. Charles Hussey at the Croydon meeting, and Mr. Corbet Woodall at the Tottenham meeting, warned the proprietors, in order that they should not pitch their expectations too high, the heavy prices for coal will rule throughout the coming year, so that the same proportion of advantage from coke cannot be anticipated. Coke will no doubt continue to command its present prices; but whether it will further improve in value will depend largely on the tendency of the coal market. There are, however, no indications at present of the course of the latter being diverted. On the contrary, since the South Suburban contracts were made three months since, there has been a further rise from the prices paid of 2s. per ton f.o.b. at the pit.

Circumstances alter cases. Whether or not the managements of gas undertakings will raise their charges for gas under the influence of higher coal prices should depend entirely upon their individual circumstances, without reference to what others are doing. We have no sympathy with those who play the game of follow-my-leader in such a matter as this, nor with those who say that, if they do not advance the charge for gas when paying higher prices for coal, the consumers will cry out against normal charges for gas when the price of coal is low. There is pusillanimity and covertness about such an administrative policy that does anything but court admiration. When market conditions are easy, and gas companies are able to supplement reserves and accumulate good undivided balances, the consumers are entitled to consideration when temporary tension is produced by an upward change in market prices. When treated with frankness, consumers are not the unconscionable beings that some people imagine. To this Sir George Livesey bore witness at the South Suburban meeting. In their case, circumstances compel an advance in the price of gas by 2d. A circular was issued to 36,000 consumers of the Company stating the reasons necessitating the rise; and there has not been a single complaint. The Company's former price was 2s. 5d. The Croydon Company are not contemplating an immediate (if any) increase of their price of 2s. 8d.; nor are the Tottenham Company of their price of 2s. 6d. Here are instances of how circumstances alter cases. The price of gas of the South Suburban Company has been lower than that of the other two Companies, their carry-forward is smaller, and their present percentage increase in consumption is not on the same high scale as in the other two Companies, through dissimilar local conditions. The South Suburban Company's carry-forward of undivided profits amounted to about £2000, Croydon to £7487, and Tottenham to nearly £20,000; while the percentage increase in business of the South Suburban Company nowhere approached the 8·27 of Croydon and the 9·93 of Tottenham. We mention these matters solely for illustrative purposes, to show how circumstances alter cases, and that the question of increasing price must, and should be, determined by individual condition, and not by any haphazard method, imitation, or suspicion that a rise is imperative to avert some dark view on the part of the consumer. That is not administration. It is something that deserves a name of a different complexion.

As already remarked, there are no present indications of a turn for the better (from the consumers' standpoint) in the coal market; and no one can possibly tell what the future has in store in this matter. Sir George Livesey views with some apprehension the effect on the price of coal of proceedings in Parliament, from which, by the way, there is to be a respite until next session. The Miners' Eight Hours Bill he regards as a disguised offspring of Socialism, for which the present Government has committed itself to stand as sponsor; and he believes that it is simply and solely intended to advance the doctrines of Socialism. However this may be, that there is no necessity for the measure has been proved beyond all manner of doubt, both by statistical facts and the evidence of disinterested people. The plea for this crusade, that a shortened working day will absorb the unemployed, has been shorn of its plausibility, and its absurdity stands in a state of nudity. To fit the case of numbers of the unemployed, Parliament would have to supplement this measure by one for a no-hour working day and good pay for those who proved themselves adept as time-

wasters. Those who want to improve their positions should try the less circuitous route discovered and successfully tried by the South Metropolitan and South Suburban Gas Companies, and partially by two or three other undertakings. The difference between the scheme as applied by the two Companies named and the Commercial Company is in the Workman-Director; and Sir George is confident, from his experience for the best part of a decade, that the Workman-Director is an essential part of the scheme. It is the one thing necessary to give the men responsibility in management, to maintain close contact with them, and to keep suspicion outside the gates of the works. The fear of Workmen-Directors using their position for the promotion only of class interests has been found to be groundless. They look at the administrative work from all points of view; and not only so, but they bring their experience of the practical operation of the concern to bear upon the administrative work. This is more than all Directors can do. United to this point is the testimony that Mr. A. E. Broadberry gave at the meeting of the Tottenham Company as to his experience of the value of technical gas men on the Board of Directors. It will be found worth reading.

Commercial Gas Affairs.

Good fortune has attended the Commercial Gas Company in the past half year. They have come out of their trading with the increased expenditure nearly balanced by the increased income from gas, rentals, and residuals; and therefore the proprietors will meet the Directors next Thursday with every satisfaction. The expenditure for the six months increased, in comparison with the first six months of last year, by some £14,089; but coal and oil alone stood the Company in for an additional outlay of £14,857. There were various other increases in disbursement, but economies in certain other items wiped them out and nearly £800 of the extra expenditure on raw materials. If the additional income had been larger by £505, a clean balance would have been struck between the revenue account of the past six months and that of the first half of last year—the amount carried to the net revenue account on this occasion being £61,806, while twelve months ago it was £62,311. The consumption of gas, it is remarked, increased by some 48,078,000 cubic feet; and the receipts for gas were £5553 better—the charge being the same. Also, in contrast with the figures of a year ago, the numbers of stoves fixed have put on a further 6000, and prepayment meters 8000. The result is that rentals produced upwards of £2000 more. Residuals yielded £5874 more; coke being the best contributor, with £5046. Breeze brought in £1324 more. Tar produced about the same; but there was a fall of a few hundreds in the receipts for ammoniacal liquor and sulphate of ammonia. The income of £263,182 was £13,584 more than a year ago, which comes very close to the £14,089 increase in the total expenditure. The figures show good administrative dealings and technical working.

Unsolved Problems of the Large Gas-Engine.

There have been those who have lamented that this country has not been in the van with continental countries in the building of gas-engines of the larger powers. That we have not been, is not really a matter for any great regret; for the experience with which these other countries have furnished the gas-engine world has brought into relief the fact that the beautiful and highly finished work that these engines present to the eye does not envelop the final solution of the great fundamental problems which must be solved before the ultimate economic stage can be reached. So far as the engines have shown inherent defect, they have—at a cost—served a useful purpose in progress, apart from their ordinary service. The jump, however, from comparatively low-power engines to these tremendously high-power ones has been too rapid—the leaps have been too great, the pace in taking them too fast. Quite different sets of conditions open out in engine building with expansion in size and power; and these have to be ascertained and conquered before, in the matters of cost of structure and resulting efficiency in action, these large engines can bear any direct ratio to the engines of smaller magnitude. The progress that has been made in solving the problems clustering about these mammoth engines, has been slow; and the difficulties are such that to-day authorities like Mr. Dugald Clerk speak with sensible caution as to the probable perfection of success. Do not hurry, but work doggedly, and with a belief that the obstinate problems confronting can be worn down by perseverance, is, in effect, the tenor of a paper he read before the Engineering Section at the British Association meeting at Leicester; and the fact that Mr. Clerk himself is continuing his researches in order to master the later problematical disclosures of experience, is a hopeful sign—however prudent he may be in expression—as to his anticipation of ultimate success.

The trend of view of engine-makers, in connection with these extraordinary structures, is that it is desirable to keep down cylinder dimensions as much as possible; and this is due, as Mr. Clerk points out, to the recognition of two facts: Practical difficulties with large diameter cylinders due to unequal expansions resulting in cracking; and a better appreciation of the fact that increase in cylinder and other dimensions requires extra expenditure in metal and workmanship in greater proportion than the augmentation in the power realized. The two main problems are to build engines of large power which will continue to run effectively and economically for long periods without breaking down, and to build such engines at costs sufficiently moderate to enable the engine to compete effectively with the large steam-engine in the matter of first cost. The first part, Mr. Clerk tells us, has been solved; but it has involved weights of material and costs of construction which are almost prohibitive, considering the moderate powers obtained. Upon which comment may be passed that the "solution" does not appear to be a very satisfactory one; and, with him, it must be agreed that sound commercial success will not be achieved with these larger type gas-engines until some better solution be found than their present construction. There must be a reduction of weight as well as of cost, and increased power from the unit. Mr. Clerk does not attempt to mask the direction of his own essay in effecting a solution of the problems besetting the gas-engine maker. His attempts are shaped towards reducing the maximum pressures, as well as temperature, without reducing the mean pressures, in order to diminish the weight of an engine for a given power, and to secure moderate thickness of cylinders and combustion chamber castings. There are several ways of doing this; but greater knowledge is required of the properties of the working fluid. The direction in which Mr. Clerk is working is in compounding—a line which others have fruitlessly pursued in the past. The problem Mr. Clerk believes is more one of working fluid than pure mechanism; and, following up this belief as he is doing, he incites the hope that he has alighted on the right track, and that he will succeed where others have failed. He has our best wishes for the maintenance of a confident spirit, and for the ultimate success to which he aspires.

The conservative attitude in the matter of these large gas-engines of British makers has been fully justified, though we cannot reject the fact that the boldness of Continental makers has opened to plainer view defects, the things to be avoided, the requirements, and new roads for investigation. Meantime it is pleasing to have Mr. Clerk's authority for again saying that commercially in the lower power machines the British gas-engine industry continues to move forward in a most satisfactory manner.

The Gifts of Science.

Possibly there are but few among our readers who noticed in the "Journal" for July 16 that two matters superficially without connection, really had a singular relationship. In that issue, there appeared the programme emanating from the Leeds University relating to the new department within which those who are intending to devote themselves to the professional work—and what a breadth that work has now attained!—of the gas industry may obtain that special drilling in fundamental scientific principles that will throw light upon, increase comprehension of, and broaden sympathy with, practical work, to the end that the man will be more valuable, his work more far-reaching. In the same issue, the new branch of work of the Leeds University received, as it deserved, editorial approbation. In the same issue, too, we recorded the death of Sir William Perkin, the greatest achievement in whose career, and the sequel to that achievement, trumpet forth the need of a greater direct application of science to the practical work of the gas industry.

Pause and consider. Men of science outside the industry have given us life and development from all points. The regenerative system of heating—producing fuel economy and heightening the yield of carbonization—came to us

from without. The bunsen burner, making possible the incandescent gas-light, and the cooking and heating stove, came from without. The very mantle, denied which competition with electric lighting would have been futile, came from without. The principles and whole development of the gas-engine—whence came they? From without. And Perkin, unidentified with the gas industry, removed the veil from the wealth of that complex substance which the gas industry so freely produces under the name of coal tar; but the gas industry and the country lacked, fifty years ago, the acumen, ability, and scientific knowledge to turn Perkin's discovery to their own enrichment. Was it therefore science, practice, or rule-of-thumb that gave us every radical part of the extensive system of production and utilization covered by the title of the gas industry? There is only one answer. We have to thank Science—Science brought to bear from beyond the confines, wide as they are, of the industry, and not from within. We do not say that, under other circumstances, the work that has been done for the industry from outside its pale could have been done better from within. But we do say that without the aid of Science the gas industry could not have survived the pressure that has been brought to bear upon it; and without Science there could not have been the development over which we are in a position to rejoice to-day. Acquiescing in this, does it not follow that, if we can bring into the industry—by combining scientific with practical knowledge—more of that to which we are so much indebted, the industry will be the better and the stronger for it. We believe there are many laurels yet to be won in the gas industry; and the worker whose intellectual capacity and force are broadened and quickened by training such as that planned out at the Leeds University (preliminary to, but not to displace, the practical experience of the works) will stand a brighter chance of winning those laurels than the man whose ideas and knowledge have been stunted by an entire training in the largely rule-of-thumb atmosphere of the workshops. We have to submit to an acknowledgment of what Science has done for the industry, and then the easier is it to appreciate the part that Science must have in our work in the future.

Perkin's life-work has been one of illustration. Let us now suppose (without suggesting that, had circumstances been different, it would have been so) the honour of the greatest discovery of Perkin had been that of a scientifically and practically trained gas man of this country. How different things would then have been for the gas industry. We should not now be perennially bemoaning the low values of tar, and looking with jealously upon the great gains that Germany has derived from the discovery of Perkin, which gains represent our losses, and losses due to indifference. If we take Mr. Consul-General Oppenheimer's report for 1906, there is reading to be had which gives indication as to the substantial character of those gains to Germany, and of the losses to this country, though some members of the German chemical industry believe that high water-mark for them has now been reached. But what a high water-mark it has been! Consul Oppenheimer says the shares of the factories stand at a great premium; and no wonder, seeing that the dividends of the different chemical factories last year are represented by such figures as 10, 12, 20, 22½, 30, 36 per cent. We see, too, that the value of the excess export by the factories of artificial dye-stuffs rose in 1906, against 1905, by 27 million marks.

These are facts; and it is not pleasant to contemplate that here we have one of the results of the want of close fellowship, until quite recent years, between Science and Industry in this country. It was Science that was kept at arm's length by Industry. Exclusiveness, self-satisfaction, self-sufficiency, indifference reigned supreme. Only under pressure was the aid of Science readily received. Things have changed now, and are still changing. On all hands, it is admitted that the greatest industrial progress has been, and must be, along the highway provided by Science; and the gas industry is not excepted. If Perkin's grand discovery, and the missing by this country and the gas industry of the fruits of that discovery, are kept in mind, together with the indebtedness of the industry to Science for all that is fundamental in it, there will not be the least difficulty in extending the heartiest sympathy and support to the larger work that is now being entered upon by the Leeds University, under the direction of certain of its learned Professors.

This very subject of our indebtedness to Science for material progress stood in the fore part of the address delivered to the Engineering Section of the British Association at their meeting in Leicester, by Professor Silvanus Thompson. It was an address which all should read who have not sufficiently appraised the relations and the interaction between Science and its practical applications. Professor Thompson propounds the inquiry, What is it that has made for our great material progress? He finds but one answer—Science. Chemistry, physics, mechanics, mathematics; it is these that have given to man the possibility of organizing the tremendous development that has been effected. But all the good does not flow from Science to industrial application. There is a reflex influence; and Professor Thompson recognizes it fully, in the pregnant sentence: While pure science breeds useful inventions, it is none the less true that the industrial development of useful inventions fosters the progress of pure science. The interaction, the mutual help, is clearly traceable, and there is mental obtuseness on the part of the man who ventures a denial.

Some Remarkable Statistics.

At the meeting of the Tottenham and Edmonton Gas Company last Saturday, Mr. Corbet Woodall quoted some really remarkable figures, which show how progress of business, prudent management, wise expeuditure of capital, and the development of efficiency in manufacturing processes, have combined to produce benefit for the consumers, the proprietors, and the undertaking itself. The figures have some bearing upon correspondence that has been proceeding in our columns as to the expenditure of capital per million cubic feet of gas sold. The amount of capital expenditure per million cubic feet of gas hangs very largely upon conditions uncontrollable by the management of a gas-works, whether it be company or municipal administratiou. If a gas company could work miracles, and produce of its own free will all those conditions that tend to the lowering of the capital per million cubic feet, there would be few, if any, that would not have taken the matter in hand long ago. A gas company cannot do much, other than by the best service it is possible to render under its peculiar circumstances, to stimulate the growth of a district. The district served by the Tottenham Company has been an exceptional one in the rate of its development in building and population. The result for the Company (who have made the best use of their opportunities) has been in the last four decades, increases in cousumption of 142 per cent., 131 per cent., 70·3 per cent., and 214 per cent. Since 1866, the capital has been reduced from £1377 per million cubic feet to £461; the price of gas from 5s. to 2s. 6d.; and the requirements of dividend and interest have fallen from 2s. 0·44d. to 6·39d.

London Progressives and Gas and Electricity Supply.

The Liberal Members of Parliament representing London constituencies are also representative of Progressive aspirations. These gentlemen are concerned over the supposed neglect of Parliament in legislating for the Metropolis, although the Metropolis is happier now than when the Progressives ruled in the local government. These well-meaning—if over-ambitious—gentlemen waited the other day upon Sir Henry Campbell-Bannerman and Mr. John Burns, and submitted to them some old Progressive notions in new dress, on which it is suggested there is "urgent need" for legislation, and asking that the Prime Minister should allow of the preparation of a Government measure for the session of 1908, dealing with as many of these subjects as he thinks feasible. Among the objects the Progressives have in view are: The institution of one uniform rate to provide for all expenditure on local government in the Metropolitan area, accompanied by such financial control in the hands of the central representative body as would "effectually secure" economy in administration; the establishment of the Central Council as the assessment authority for London (we kuow well the views of the Progressives as to higher assessments); and some arrangement whereby the water, gas, and electric undertakings of London shall fall ultimately into the possession of the Central Council. The Metropolitan Gas Companies are so used to this proposal, that in Horseferry Road, Old Kent Road, and Stepney the objects of the visit of the deputation to Sir Henry were, we venture to assert, read without the slightest flutter of excitement. The upshot of the visit was that Sir Henry put off the aspiring Progressives as kindly as he could. There were no promises of

legislation for next session; but there was the vague one that the Prime Minister would see to it that these aud the other "important" questions brought before him should be dealt with ere the Government were laid to rest. Mr. Burns also feelingly promised legislation "at the earliest convenient opportunity" npon those matters on which unanimity prevailed——among whom, the Progressives or the people of London? With professions of the greatest sympathy ringing in their ears, the deputation left the presenee of the Premier and the President of the Local Government Board. Ineidentally, it is noted that Progessivism and Communism are one and the same thing, and also that the Progressives, though anxious to be some day the sole purveyors of eleetricity in London, are satisfied that the gas industry is not doomed, but is worth having in their possession.

A Joint Advertising Scheme for Gas.

Until last week, nothing further has been heard of the proposal, launehed by Mr. F. W. Goodenough at the meeting of the Institution of Gas Engineers, for a fund subscribed by gas undertakings for advertising in publieations that have universal eireulation. But a few days ago, a copy of the "Advertising World" eame to hand; and there we find, in an artiele on the suggestion, that it seeures the complete approval of the editor. Our contemporary remarks:

> As Mr. Goodenough said in his paper, there is an important field for advertising in periodicals which cover a vastly wider field than the area of supply of any one company; and it is not to be expected that a single company should bear all the expense of gaining a publicity which must benefit the industry as a whole. It will be interesting to note whether a suggestion so obviously sound meets with the support it merits. If it is allowed to fall to the ground with no result, the gas manufacturers of this country will be convicted of a deplorable lack of enterprise. But better things may be hoped for—the leaven of a new spirit of what would once have been considered a dangerous experiment, has slowly permeated the whole lump of even our conservative commercial world, and even the most cataleptic of concerns are evincing a tendency to wake up. Mr. Goodenough's proposal won such warm commendation from subsequent speakers, that it is almost certain more will be heard of it.

We are afraid there will not be, unless some one in the gas industry sets to and makes a move in the matter. We have our own views as to what provineial gas undertakings will think of the seheme; howbeit, we should like to see the idea tried, believing in the largest possible range of attractive but not vulgar advertising. The cost per undertaking would be very trifling. Who will give the matter a push forward?

An American View of Municipal Ownership.

Some of our readers are doubtless aware that an important investigation into the subject of municipal trading has been earried out by the Amerieal National Civie Federation. It may be remembered that some time ago a representative Committee came to this eountry for the purpose of inquiring into British local government and the trading eoncerns assoeiated with it. The Federation have lately issued several reports, whieh contain a great variety of opinions. In their final report, however, nineteen out of the twenty members of the Commission affix their signatures to what practically amounts to a condemnation of munieipal ownership as praetised in the United States. In their opinion, such ownership should be limited to matters affecting the publie health, public safety, and transportation; and they consider it should "not be nndertaken solely for profit." Their investigations teaeh them that no municipal operation is likely to be highly suceessful that does not provide for an executive manager with full responsibility, holding his position during good behaviour; for the exclusion of political influenee and personal favouritism from the management of the eoncern; for the separation of the finances of the undertaking from those of the rest of the city's business; and for exemption from the debt-limit of the necessary bond issues for revenue-producing utilities which shall be a first charge upon the property and revenues of sueh undertaking. They suggest that no stocks or bonds for public utilities should be issued without the approval of some competent authority; and they recommend the eonsideration of a sliding-scale, which they say has "proved suecessful in some cases in England with reference to gas, and has been adopted by Boston." The effect of its adoption was shown in our columns last week.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 469.)

It has been said that we live in a reeord-breaking age. Originally applied to sports and pastimes, it seems now to be specially applieable in grim earnest to serious business. Lately from week to week we have had to note fall npon fall of the choicest of onr investments; and now we have to note a fnrther fall still. What may yet be attained would puzzle even a Chaneellor of the Exchequer (who a month ago told ns that $84\frac{1}{4}$ was Consols' bottom priee) to say. We never prophesy nnless we know. It is not easy to put one's finger on the plagne-spot that caused all this decay. Probably there were many, some acting and reacting on eaeh other. The condition of things in Wall Street and the tightening of money were two of them; while a general uneasiness prevailed as to "what was going to happen next." When matters are like this, even a small selling order will sometimes knoek priees down—arousing an nneasy suspieion that the seller has got some first-hand information. When the Exchange re-opened on Tuesday, there was some show of eheerfulness, founded npon a little buying; bnt it did not last. Wednesday was very quiet, and prices shrank for lack of support; Consols dropping $\frac{1}{4}$. Thursday was worse, with a very flat tone; Consols marking $81\frac{3}{4}$. Friday opened with deeeptive promises followed by renewed weakness; everything exeept Americans and South Afrieans being bad, and Consols touching $81\frac{3}{16}$. Saturday was not so bad all round; bnt Consols actually marked $81\frac{1}{16}$. In the Money Market, the rates for short loans were somewhat variable; but discount showed a hardening tendeney all throngh. Business in the Gas Market began to shrink to its normal proportions in August; and, as might be expected, priees were at least to a slight extent influenced by the generally dull tendency. In Gaslight and Coke issues, the ordinary was moderately dealt in at pretty close figures, which ranged only from $94\frac{1}{2}$ to $95\frac{1}{2}$. Not mueh was done in the secured issues; the maximnm marking from $88\frac{1}{2}$ to $89\frac{1}{2}$, and the preference from 105 to 107. South Metropolitan was very quiet at 122. In Commereials there was only one bargain in the 4 per cent., at 104; bnt the buying prices of the two issues were lowered. In the Suburban and Provineial group, Brighton original was done at $222\frac{1}{2}$. The Continental Gas Companies were very inactive; Imperial ehangiug hands at from $173\frac{1}{2}$ to $174\frac{3}{4}$ (a fall of $\frac{1}{2}$), Union preference at 140, and Enropean fully paid at $22\frac{1}{2}$ (a fall of $\frac{1}{2}$). Malta was done at $4\frac{1}{2}$. Among the undertakings of the remoter world, Bombay new realized $5\frac{1}{8}$, and Oriental $142\frac{1}{2}$; Primitiva was done at $6\frac{15}{16}$ and $6\frac{3}{4}$, ditto preferenee at $5\frac{1}{8}$ and $5\frac{1}{32}$, River Plate at from 13 to $13\frac{1}{8}$, and ditto debenture at 94 and $94\frac{1}{4}$.

ELECTRIC LIGHTING MEMORANDA.

"Meteor" on Gas and Electricity Meters—A Travesty of Facts—The Exactitude Obtained in Gas-Meter Manufacture—Changing Suppliers and Prices without Warning—How to Prove that Gas is Dearer than Electricity—London Electric Supply Bill withdrawn.

Anger, pure and alloyed, has moved "Meteor" of the "Electrical Times" to write about electricity and gas meters. The cause of irritation is a pamphlet circulated by the Reading Gas Company, in which electricity meters are not praised np as instrnments of relianee and virtuous behaviour. The stinging words in the pamphlet are these: "The electricity consumer has no proteetion. He is committed to the readings of an instrument whose good faith has no guarantee, and whose abiding honesty even electricians will not vouch for." The "Journal" was originally responsible for these words. "Meteor" says "the poliey that makes this half-truth the basis of such foolish misstatements cannot enjoy a very long and prosperous career." The hostile "Meteor" affeets to show that the electricity consumer has protection; but it is a poverty stricken sort of protection, as compared with that given the gas consumer. He says that "the eonditions under whieh the consumer *may call* upon the undertaker"—yes, the undertaker—"to supply a certified meter are duly laid down by Act of Parliament." There is the tronble. Householders do not as a rule purchase Acts of Parliament and pore over their contents before they become consumers of electrieity. Where, then, is the protection? The sound protection that electricity consumers should have is that given by the Sales of Gas Act to gas consumers, among whom there is not a single meter plaeed that has not been tested and stamped at some offieial testing-place. It is not a question of "may call" with the gas consumers; it is a question of "must have." That is real protection. Then there are the conditions, "Meteor" says, under which the electricity consumer may have his meter re-tested ("*re*" if it has already been tested) if it be suspected of registering ineorreetly. How many consumers know of these things?

"Meteor," with his fine ability at catching at straws to help his argument, says he "believes it was during the first week in June that the Chairman of the Manchester Gas-Meter Testing Committee announeed that gas-meters known to be reading incorreetly to the extent of 40 to 50 per cent. were sent to various official testing-stations for report. These were returned to Manehester in

nearly every case marked as correct." How this loose statement helps "Meteor," it is difficult to see. The fact of the matter is he is off his own ground here, and does not appear quite certain of what he is writing about. In Manchester last year, the official report states, there were 43,868 gas-meters tested under statutory conditions; and only 1·31 per cent. were rejected. But in Manchester they have a supplementary test known as the "index test;" and the total number of cases of defect found under this test—remember there were 43,868 meters tested—was only 96! It was these meters that had been found correct under the registration test; but the supplementary test had revealed defects not discoverable under the ordinary test, and it was then possible to make the necessary adjustment to produce perfection before stamping the meters as fit and responsible instruments for use. What "Meteor" looks upon as a point helping his case really shows the great care taken to ensure positive accuracy in gas-meters before stamping them as correct under the Sales of Gas Act—an Act the like of which, compulsory and stringent, the electricity industry has not so far had applied to it. The London County Council and others should move in this matter of getting a similar Act applied to the electricity industry. We recommend "Meteor," if he has not already done so, to get a copy of the Act, and fortify his knowledge as to gas-meter testing and stamping, and then place it alongside the milk-and-water provisions referring to meters in the Electric Lighting Clauses Act of 1899. Now what does "Meteor" mean by talking about half-truths after the version he gives of the Manchester statement?

Let us see what other official reports say. In one of their reports on a twelvemonth's testing, the officers of the London County Council state that 2396 new electricity meters were tested by them, of which only 1226 (or 51 per cent.) could be passed as accurate at the first testing; 410 (or 17 per cent.) were passed as accurate after adjustment and further testing; and 760 (or 32 per cent.) were rejected as inaccurate. How many meters were fixed during that year in the Administrative County of London that were not tested by the County Council? It would be very interesting to know. In one of his reports, the Lighting Inspector of Liverpool stated that in the course of the year 4654 gas-meters were tested for the Gas Company, of which only 105 were rejected as inaccurate (2·2 per cent.); 2981 electricity meters were tested, and no fewer than 1089 were rejected as inaccurate (or 36½ per cent.). In the year ending March 31 last, 71,358 new gas-meters were tested by the Middlesex County Council; and out of this large number, only 2640 were rejected. The Inspector to the Corporation of Reading had 1050 meters submitted to him last year; and only 21 were rejected. The figures from these various reports speak well for the exactitude obtained in the manufacture of gas-meters. More need not be quoted. But we should like to know whether "Meteor" is of opinion that the electricians who took part in the "Electrical Review" correspondence on meters in the summer of last year were simply frothing; and whether he thinks that Mr. A. C. Hanson who was writing in the same paper a short time since did not know what he was talking about, when he said: "Even with careful supervision, it is impossible to ensure that a large proportion of meters will even start on a 220-volt 8-candle power lamp." Meters that fail in being a positive arbiter of consumption on one side may be depended upon for not being very particular on the other side. Of course, "Meteor" may know more about these things than practical electricians.

In most businesses where custom is regular and not casual, it is deemed but a common act of courtesy to inform the customer of any change of ownership of the business, and certainly of any variation in price of the commodity supplied. The Marylebone Borough Council have recently had certain portions of Hampstead incorporated in their administrative bounds, and by agreement, under the London Electric Lighting Areas Act of 1904, the same portions were transferred to Marylebone for electric lighting purposes. Of this transfer, the consumers (according to one electrical paper) do not appear to have had any notice or warning; and for them up went the cost of electricity without their knowledge. The Hampstead rate was 4d. a unit, but the Marylebone rate was 8d. per unit up to 200 hours' use a quarter, after which it came down to 1d. Certain of the consumers, on finding that their electricity bills had doubled, declined to pay any more than the Hampstead rate; and for standing out against what they considered to be a great injustice and, we may suppose, impertinence, they were hauled up at the Marylebone County Court, where His Honour Sir William Selfe sympathized with them, but told them they must submit. Whether this is good law or not has to be determined; but when an agreement is made to take a supply of gas or electricity, that agreement is based on the current or a contracted price. The contract price cannot be altered without ending the contract or by the concurrence of both parties; nor should the price upon which ordinary business relations are entered be altered without notification to consumers. In this Marylebone case, it appears that the price was altered; and we hope the defendants will appeal, and test whether a commodity at a higher price can be supplied to them without as much as "by your leave." The Act, it is stated, gave the Marylebone Council the same powers over the added portions of the borough as they had over their original part. This may be agreed; but it surely does not invest the Council with the right to secretly take a man over as their customer, on their own terms, without as much as allowing him the opportunity of saying whether he desires to continue his custom under the changed circumstances.

We have to thank Mr. Kenelm Edgcumbe, on behalf of the gas profession, for his good opinion. "So long," he says in a letter to the "Electrical Review," as it is simply a question of juggling with candle powers, the gas 'expert' [he quotes the word 'expert'] is *facile princeps*." Mr. Edgcumbe belongs to the school of finical electricians who wander among candle powers per hour or per annum, "mean candle-foot to 20 yards," and work out figures to the third place of decimals, to prove that electricity is cheaper for street lighting purposes than gas. They eschew altogether, as being beneath their notice, such gross figures as those shown in the annual accounts of public lighting authorities. To arrive at his costs per mean candle-foot per yard length of street, Mr. Kenelm Edgcumbe has been using a Trotter "Universal" photometer; and after an amazing "juggling" with figures—if it is not juggling, what is it?—he arrives at these among other results: Osram lamp, using 105 watts per hour, mean candle-foot to 20 yards, 0·098; while a low-pressure gas-burner, consuming 4·25 cubic feet, returns only 0·04! The relative cost of gas and current (at 2s. 2d. per 1000 cubic feet and 1½d. per unit), he gives as 1·2 and 2·1. How transparent and simple! We are not going to worry out what Mr. Kenelm Edgcumbe means; but we should advise him to make his illumination tests and comparative costs so that the people who have to pay for the lighting can understand them. He suggests that, if station engineers could be persuaded to make a few simple illumination tests in their own districts, they would have authentic figures to lay before their lighting authorities, instead of mere candle power. We should advise station engineers not to attempt to perplex their lighting authorities by following Mr. Edgcumbe's abstruse example, however great he may be as a man of light and leading, however big he may be as an "expert," and however "*facile princeps*" and saintly he may be when dealing with gas and electricity figures. Lighting authorities want something they can readily comprehend. We guarantee they would be staggered by Mr. Edgcumbe, but would much more readily appreciate certain passages in a report by Mr. H. Faraday Proctor, the Electrical Engineer of Bristol. Mr. Proctor tells his Committee that tests made at the Temple Back works with "Osram" lamps show that (taking the current prices for electricity in Bristol) an Osram lamp giving 32-candle power costs about 15 per cent. less per hour than an average 16-candle power carbon filament lamp, including lamp renewals in either case. There is something definite about this statement, which is much more satisfactory than those calculations that do not enlighten, but confuse the man in the street, and are subject to all sorts of local disturbing factors.

The Electric Lighting Companies of London have been driven into a corner with their joint scheme. Their Bill has been left derelict until last week, when it was withdrawn. There was, with the session so far spent, certainly no prospect of getting it considered this year; but perhaps the Companies were not particularly anxious for it to be considered after the rejection of the London County Council Bill, and danger had thus been removed. But there can be no doubt that the respite from trouble is only a very temporary one; for someone is sure to have an early shot to obtain authority for power and bulk supply, now that the County Council have shown that the will of the ratepayers is superior to their own in this matter. The suspense and uncertainty, however, must be intolerable for the existing undertakers; but it is a pity they do not try to make themselves secure by united action against these repeated attacks. Mr. Lloyd-George does not despair of something being done in a few months' time; but at present he cannot see how to bring the Municipalities, the Electricity Companies, and the London members to see things from one point of view. There must be, in his opinion, a common understanding on main principles before anything can be accomplished. There is a hint here for the existing undertakers. The question is whether there cannot be some "common understanding" which will prevent an outside concern coming in to depreciate the 20 millions of capital already involved in electricity supply in London.

Dr. Bueb and the German Continental Gas Company.—It is announced that Dr. Julius Bueb, well known as the designer of the Dessau vertical retort, and patentee of several processes in connection with gas manufacture, gave up on the 1st of July last, by amicable arrangement, his post as Chief Chemist to the German Continental Gas Company. He will, however, hold the position of their Technical Adviser.

The New Paris Gas Company.—Though the concession for the future gas supply of Paris was placed some time ago, certain difficulties arose which till quite recently prevented the completion of the arrangements. Everything, however, is now in order; and the Company will enter into possession on the 1st prox. The concession is for twenty years; and the price will be 20 c. per cubic metre (4s. 6d. per 1000 cubic feet), subject to reductions of not less than 0·5 c. when the profits allow of the payment of the City's share of 20,000,000 frs., and a complementary sum of 150,000 frs. to the Company. Each new consumer will have to pay a deposit equal to 5 frs. per burner, to be refunded on the service being discontinued. The charge for a 5-light meter will be 90 c. per month; the rental for larger sizes rising in proportion. The registered representative of the Company is M. Rouland, a Parisian engineer; the President of the Administrative Council is M. Adolphe Carnot, a member of the Institute of France, and formerly Director of the School of Mines; and the General Manager is M. Léon Martin.

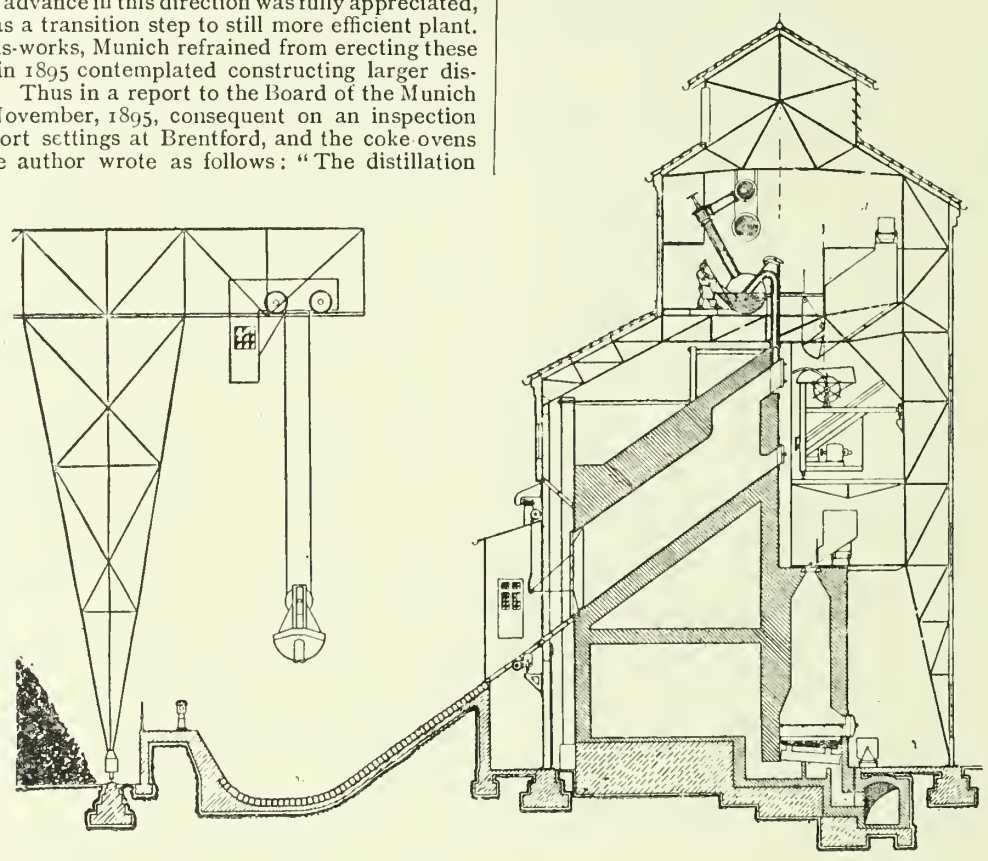
THE MUNICH CARBONIZING CHAMBERS.

The report of the proceedings at the meeting of the German Association of Gas and Water Engineers at Mannheim, which appeared in the "Journal" for June 18 last, embodied (p. 810) a summary of the communication which Herr Ries, the Manager of the Munich Gas-Works, made to the meeting with reference to the carbonizing chambers that have been in use at his works. The paper by Herr Ries and a report (not presented, though referred to at the meeting) by Dr. Bunte on behalf of the Carlsruhe Experimental Gas-Works, on the working of these carbonizers, have been published in full in the "Journal für Gasbeleuchtung" for the 3rd inst. The following abstract translation of Herr Ries' paper has been prepared by way of supplementing the particulars already given in the "Journal." Dr. Bunte's report will be dealt with in a subsequent issue.

THE MUNICH CHAMBER SETTINGS.

By H. Ries, the Manager of the Munich Gas-Works.

The desire to simplify the work of carbonization has been very strong at these, as at all large gas-works. The importance of the Coze settings as an advance in this direction was fully appreciated, but was regarded as a transition step to still more efficient plant. Like many other gas-works, Munich refrained from erecting these settings, and even in 1895 contemplated constructing larger distillation chambers. Thus in a report to the Board of the Munich Gas Company in November, 1895, consequent on an inspection of the inclined retort settings at Brentford, and the coke-ovens at Dahlhausen, the author wrote as follows: "The distillation ovens of the coke-works at Dahlhausen appear to represent a type of gas-making oven which should fulfil all requirements. The difficulties which the adaptation of the coke-oven to gas-works conditions presents are not to be underrated; but, on the other hand, it does not seem impossible to combine producer firing with the chamber oven. Gas manufacture will first attain a position of greater independence of human labour and cheap working with such a system of ovens."



Cross Section of the Munich Carbonizing Chamber.

The first projects (made jointly with Dr. Schilling) for a large chamber oven date from 1896; but their realization had to be postponed, because the Gas Company had no interest in pursuing such experiments, in view of the fact that the works were to pass into the hands of the Municipality in 1899. Neither were the first few years of municipal control favourable to such researches; and hence it came about that a trial oven was not erected until 1902. The results, which were communicated in 1903 and 1904 to the Bavarian Association of Gas Managers, need not be now quoted. By repeated re-building, the oven was ultimately so designed, and such results were obtained over a prolonged period of use, that a final installation of five beds, containing in all fifteen chambers, was proceeded with. It was to take the place of six beds of eight retorts which were scheduled for breaking up. The plant, which was to be equipped at once with all the requisite coal-conveying machinery, required considerable outlay, which the Munich Corporation willingly agreed to. The completion of the work, however, was delayed many months owing to strikes and locks-out; so that actually the plant only started working on Oct. 5, 1906.

The preceding illustration shows the arrangement of the plant. Three carbonizing chambers are erected in each regenerative setting. Between the floors of the chambers, which are very massively built, are the gas-nozzles, and above these and between the chambers the heating flues, of which the upper portions pass partly over the tops and partly to the rear walls of the chambers in order that they may pass down on the other side of the chambers to the regenerator. The chambers are set at the angle which is necessary for the automatic settling of the coal and the sliding out of the coke. The closing of the doors or openings in the chambers had to be carefully effected. Gas-tight closing of the small openings on the charging side presented no difficulty; but there was much more trouble with the large discharging opening. This, however, has now been completely overcome. The charging openings are opened and closed by hand. The discharging door is operated by means of a small trolley travelling in front of the settings. In a later type this door is raised and closed by a few moves of a handle. A screen is provided on the door inside the chamber in order to prevent the coal being forced down into the discharging mouthpiece. The pressure of the coal on the door is transferred by appropriate design to the bracing of the setting. Generally the slab of coke begins at once to move downwards when the discharging door is opened; but if it needs a push, an expelling device, moving on the rear wall and easily manipulated, is used. Its head pushes the rear of the slab of coke.

A bunker, of the same capacity as the carbonizing chamber, is placed at the back of and behind the chambers, for charging them with coal. Coal is conveyed to the bunker by customary machinery; the large lumps having been broken to nuts about 4 inches in diameter. The coal is run in from the bunker to the chamber by means of a travelling tipping trough, one end of which enters the mouthpiece of the chamber, while the other is attached to the outlet of the bunker, which is provided with a flap valve. The slab of coke issuing from the chamber slides over a shoot supported by a trolley into the open. Special arrangements have not been provided for removing and quenching the coke, because the old retort-house is not well adapted for them, and also it seemed desirable first to prove the continued utility of the new chambers. A very simple and cheap plan was followed, with good results. In front of the retort-house is a pit about 13 feet wide, and 4 ft. 6 in. deep, of which the floor seen in cross-section first follows the slope of the shoot and then gradually comes to the horizontal. The slab of coke therefore coming from the carbonizing chamber breaks up at the point where the floor of the pit takes an altered direction—generally by splitting lengthwise, so that half falls to the right and half to the left.

The coke is quenched in the pit, and for the time being is removed in barrows; but ultimately, when the plant is extended to the whole of the retort-house, the manual work will be displaced by a small travelling skip. There can, of course, be no obstacle to the mechanical quenching and conveying of coke which is adopted with other systems of settings; but the very cheap arrangement mentioned seems quite suitable for a moderate scale of working.

Each setting has its own hydraulic main, entered by three wide ascension pipes. It is roomy and accessible for cleaning. The producers are on the charging side of the bench, and are sufficiently large for refilling to be required only at tolerably long intervals. The discharging and charging of a chamber take

place in this manner: The charging and the expelling openings at the charging end are opened, and then the discharging opening. If the slab of coke needs a push to start it sliding, one is given by a few turns of the winch, by means of which the pusher-head is pressed through the expelling-opening on to the upper end of the slab of coke. The latter then slides down in a few seconds into the quenching pit. The discharging door and the expelling opening are then closed, and the tipping scoop is brought to the charging opening, the slide on the outlet of the bunker is drawn, and, if the bunker is properly placed, the charging is finished within from 20 to 30 seconds—almost without any smoke or flame. The coal settles in the chamber at a uniform depth almost up to the mouthpiece. The charging opening is then closed. The discharging and charging of each chamber normally take about 3 minutes. The work requires two men on each side of the bench; and they could attend to ten to twelve settings with 30 to 36 chambers in an eight-hour shift. As the carbonizing time is 21 hours, for the rest of the day one man suffices to look after the settings and attend to the heating.

The uniform heat of the walls and bottoms of the chambers is striking, and is secured by the appropriate disposition of the gas-nozzles and the heating flues. The average temperature in the heating flues between the walls of the chambers is 1250° to 1300° C. (2280° to 2370° Fahr.); and the chimney gases leave the setting at about 350° C. (662° Fahr.). There is considerably less external radiation than with Coze settings. The whole house remains nearly free from fumes while the charging is in progress, and in this respect compares very favourably with the ordinary retort-house. Especially interesting was the behaviour, on prolonged use, of the walls and floors of the chambers where most exposed to wear and tear and the effects of heat.

The bottoms of the chambers have so far undergone no change, and show no signs of any dropping. The walls of the chambers have also behaved well, notwithstanding the fact that no special allowance was made in the existing settings to prevent sagging. Trifling deformations of single chambers, due to over-heating, which have occurred could be rectified in a short time without injury to the walls. In order to try another kind of fire-brick, however, the experiment was made of changing the wall of a chamber without taking away the mouthpiece; and the work was accomplished successfully owing to the ready accessibility of the chambers. The whole block of settings is also in good condition externally. Deflection of the comparatively weak bracings is scarcely to be observed, and in particular the sliding down of the brickwork towards the face of the bench, which occurs with Coze settings, does not take place.

Working Results.

Very much the same occurs in the chamber in the course of 24 hours' carbonization as occurs in retorts. The heat issuing from the walls first attacks from all sides the outer layer of the prism of coal, and gradually works inwards. Gasification and coking proceed by similar stages. In accordance with the duration of the heating action and the reduction of the pressure of the overlying coal, the density of the coke diminishes somewhat from outside inwards and from below upwards. The escape of the gas upwards and within the less highly-heated middle layer is thus facilitated, and the concomitant advantages secured. With all the kinds of coal so far carbonized, it has been found that the slab of coke is detached from the walls of the chamber—there being an intervening free space about ½ inch wide. This occurred almost to the same extent with Saar, Ruhr, Saxony, Bohemian, German-Silesian, and Austrian-Silesian coals, and is favourable to the ready removal of the slab of coke and the preservation of the walls of the chamber.

The deposition of carbon as scurf is smaller than with retorts for the same make of gas. Removal of the scurf is only necessary every six to seven weeks. On the walls the scurf is in thin plates, which are easily detached, and often come out with the coke. On the upper part, it forms a thicker and harder layer, filling up the angles; and this has to be removed by burning off. The latter procedure may, however, be considerably postponed if the carbon deposits are removed by rubbing with a scraper before each charge while they are still flaky and soft.

The working results obtained in November last year indicated that the expectations derived from the earlier trial-settings were being fulfilled; but before proceeding to any extension of the system, it was desired to have an authoritative report on the settings. Dr. Bunte undertook to furnish this through the Instructional and Experimental Works of the German Association of Gas and Water Engineers; and an accurate investigation of the settings was carried out from the 7th to the 16th of February under his personal supervision. The investigation was made on three settings, and consequently nine chambers, with Saar coal. It was made in two series. In one the chambers were all charged at about the same time, so that the true course of the distillation process over the 24 hours' carbonizing period could be observed in detail. In the other series, the chambers were charged at the usual working intervals; and 24-hour periods were taken for the observations.

The details of the arrangements for the investigation need not be referred to by the author; it will suffice to say that they were very interesting, and involved an immeuse amount of labour on the part of Dr. Bunte and his collaborateurs. He has only found it possible so far to deal with the more important experimeutal results; and these form the subject of a provisional report which is being published co-temporaneously with this paper. [A summary of the results has, however, already been given in the "Journal" for June 18, p. 810.] Briefly it may here merely be pointed out that the yield of gas averaged in the seven trials 11,784 cubic feet per ton of Saar coal.

The evolution of the gas from the chambers at the several stages of distillation is very uniform. The production rises rapidly in the first half hour after charging, then falls off slightly for the next three hours, and continues from that time to about 18 hours at nearly the same rate. There is then a steady fall to the minimum at 24 hours. The illuminating power of the gas follows a similar curve to the make. In the first half hour it attains its maximum of 27 to 30 Hefners (24½ to 27¼ candles), then falls uniformly during the next three hours to approximately the average value, which is maintained for a long time, though there is a regular drop towards the end of the distillation. [According to Dr. Bunte's report, the illuminating powers referred to are the values of the gas when tested in a slit or batswing burner at the rate of 150 litres (5·3 cubic feet) per hour.] The calorific power and the specific gravity of the gas are also at a maximum in the first hour, and fall off by uniform small drops to their lowest values at the end of the period of carbonization. The curves for make and quality naturally depend primarily on the temperature of carbonization, and the consequent duration of that process. The higher the temperature, the greater is the make of gas at the expense of its illuminating and calorific values. It is therefore open to us to make either a normal quantity of gas of high quality or a large quantity of lower quality. As a rule, for practical reasons the heats of the settings will be so accommodated to the relative ease of gasification of the various kinds of coal that the process will not be completed much earlier or later than 24 hours from the time of charging. Thus the arrangemeut of the shifts of workmen will continue unaltered, and excessive expenditure of fuel will be avoided.

The yield of coke with Saar coal amounts to about 67 per ceut. of the weight of coal. The coke is in large lumps, somewhat harder and denser than retort coke, but not so dense that its use in domestic stoves would present any difficulty. The breeze only amounts to 1·8 per cent. The quantity of tar is about 6·1 per cent. of the weight of coal, and of ammoniacal liquor about 7·3 per cent. On an average, coke amounting to 15·32 per cent. of the weight of coal carbonized was used as fuel for heating the settings; but this consumption may still be reduced. With larger carbonizing chambers, it should be still more favourable. Dr. Bunte's results on the yield of ammonia and cyanogen are not yet fully presented; but there appears to be a considerable increase iu the yield of ammonia, and a diminution of the cyanogen.

A make from Saar coal of nearly 11,800 cubic feet of gas per ton, with a gross calorific valuc of 662 B.Th.U. per cubic foot, an illuminatiug power of 10 to 11 candles with a slit burner at the rate of 5·3 cubic feet per hour, and a make of bye-products equal to, and even in many respects quantitatively and qualitatively better than, retort practice, must all be admitted as results which can be economically attained with the large chamber setting. It has been further established in experiments with the first settings that the make of gas can be considerably increased by introducing steam into the chambers during the last few hours of carbonizatiou; but the results of recent trials of this procedure are uot available. Some are about to be made. The working of the chamber settings has so far been entirely satisfactory, and has displayed the simplification which was aimed at. The retort-house, with its noise and reek night and day, has become a quiet and airy building, with only one man in attendance after charging is finished.

The five chamber settings at the Muuich works make from 14,000 to 15,000 cubic metres (say 495,000 to 530,000 cubic feet) of gas per diem, or from 2800 to 3000 cubic metres (about 99,000 to 106,000 cubic feet) per setting. They were built of a size to afford this make. They are united in one bench, which is nearly 67 feet long, 15½ feet deep and 34¾ feet high. The height could be readily reduced by from 3 to 5 feet by the adoption of a more efficient system of regeneration; it was determined in the present case by the existing retort-house conditions. The five producers stand in front of the beuch on the charging side, and are 6·56 feet long, 7·2 feet wide, and 13·45 feet high. Each carbonizing chamber holds from 2½ to 3 tons of coal; but there would be no difficulty in making, under the same method of construction, settings having auy productive capacity up to 6000 cubic metres (212,000 cubic feet) per diem. The dimensions of benches of five settings of larger productive capacity would be approximately as shown in the following table:—

Make per Setting per Diem.		Bench.		Five Producers.		Average Height of Settings in Feet.
Cubic Metres.	Cubic Feet.	Length. Feet.	Depth. Feet.	Length. Feet.	Depth. Feet.	
3000	106,000	72½	15·1	6·23	7·22	29·2
4000	141,000	,,	17·1	6·89	7·54	32·5
5000	176,000	,,	19·3	7·87	7·54	36·1
6000	212,000	,,	21·0	7·87	7·54	39·0

The productive capacity per diem per square foot of area comes out about as follows:—

Gas Made per Setting per Diem.	Per Square Foot Area of Setting.	Per Square Foot Area of Retort (Chamber)-House.
Cubic Feet.	Cubic Feet.	Cubic Feet.
106,000	427	164
141,000	492	213
176,000	558	262
212,000	623	295

The height of the house from the floor of the producer to the principal truss would be 40 to 50 feet, according to the size of the settings; and the width 36 to 46 feet. It need not be further explained that the ground space for the building and the coal-bunkers could be much economized by putting in one house two rows of settings with the charging sides facing one another. Owing to the relatively small heat radiation and the easy work, such an arrangement would prove more satisfactory with the chambers than with Coze settings.

Economy of the Chamber Settings.

The five existing settings have required two stokers on each side of the bench; and the charging of the fifteen chambers occupies these four men about three hours. With an arrangement for removing the coke more rapidly, the four stokers could doubtless attend to twelve settings in an eight-hour shift; thus the daily make per man per eight-hour shift would be 318,000 cubic feet, or with larger settings more—viz., for the 141,000 cubic feet per diem settings 424,000 cubic feet, for the 176,000 cubic feet settings 530,000 cubic feet, and for the 212,000 cubic feet settings 635,000 cubic feet. The maintenance of the settings during the eight months' working, comprising 1059 setting-days, with a make of 106 million cubic feet of chamber gas, has not presented any special requirements, and no repairs or renewals have been needed with those settings which have been continuously at work for that time. This leads to the conclusion that the chambers will last much longer than retorts, and that the cost of maintenance of the chamber settings will be much lower than that of retort-settings. The economy is, of course, greater the more regularly the year through the chamber settings can be worked in such numbers as to keep the staff of stokers fully employed, and if the accessory machinery is relatively well occupied.

The most prominent advantage of the large chamber settings lies, however, in the labour conditions. The number of men employed is reduced to a minimum. A house containing twelve chamber settings, and having, therefore, a productive capacity, according to their size, of from 36,000 to 72,000 cubic metres (1,270,000 to 2,540,000 cubic feet) per diem, requires for charging and discharging only three or four men for eight hours; whereas fifteen to thirty would be employed day and night for a similar production with horizontal retorts. Night work can be done away with, except for a watchman, who can also attend to the producers. The conditions are also lighter and hygienically far superior. All these advantages have been quite clearly demonstrated by the working of five chamber settings at Munich, though these are not so complete in some respects as later experience indicates they should be. A longer time is required in all such cases for full development.

(To be continued.)

THE BUEB VERTICAL RETORTS AT COLOGNE AND OBERSPREE (BERLIN).

Remarks of Mr. E. Korting.

It has already been reported in our columns that after Herr Prenger, the Manager of the Cologne Gas-Works, had described the installation of vertical retorts at those works before the recent meeting of the German Association of Gas and Water Engineers,* Mr. E. Körting, the Manager of the Imperial Continental Gas Association's works at Berlin, made some observations on the working of vertical retorts. His remarks have now been published *in extenso* in the "Journal für Gasbeleuchtung;" and we may appropriately supplement the earlier brief report by quoting from our German contemporary.

Mr. Körting said he had several times seen the beautiful installation of vertical retorts at Cologne; and it was as carefully thought out and comprehensively planned as everything on Herr Prenger's wonderful works. They all regretted that as yet no working results were available. He could, however, present some from the Oberspree works at Berlin. It was necessary to bear in mind that he who took part in working a new invention came under the suspicion of always looking at its results through rose-coloured glasses. However, he hoped to recover the confidence of his hearers when he stated that the results now achieved on the large scale were considerably more favourable than those he had previously published for the trial settings. In any case, he had now proof that he had nothing to withdraw from what he had said in regard to the latter.

The Oberspree works were only small. This was advantageous, as they had thus been able to work there for several months past entirely with vertical retorts, and so obtain as precise results as possible. The works, however, were not large enough for them to have there either an academically trained engineer or a chemist. The units also were far too large. All these things were naturally unfavourable to the results. Nevertheless, the fact that the installation had so far given him nothing but satisfaction was decidedly a proof of the trustworthiness of the working of the settings of verticals. A great number of different coals were used at the Oberspree works. In order, however, to give results from a known variety of coal, he had made a nine-days' trial with Westphalian coal (Hibernia and Wilhelmine Viktoria). On an average, they had obtained from 100 kilos. of this coal 37 cubic metres (or 13,277 cubic feet per ton) of gas, having a calorific power of 592 B.Th.U. per cubic foot. The make per retort per diem exceeded 14,833 cubic feet. The make of tar, on the average of two months, was 5 per cent. of the weight of coal; the ammonia, 0·36 per cent.; and 54 per cent. of coke remained available for sale.

These results were all that had been expected; and he could assure his audience that the financial results were in keeping with them. He would not enter into details; it would suffice to say that in May last the small Oberspree works did considerably better than the average of all the rest of the large Berlin works of his Association. The big installation at Mariendorf, which would come into operation in the autumn, was exactly on the same lines as that at Oberspree.

The rest of Mr. Körting's remarks referred to his paper on the "Vertical Retort-House at Oberspree," of which a translation was given in the "Journal" for the 18th of June last (p. 804). But in reply to an inquiry as to whether the yield of 37 cubic metres per 100 kilos. had been obtained with or without the introduction of steam into the retorts, he stated that it was with steam.

* See "Journal," Vol. XCVIII., pp. 810, 1000.

GAS PRICES IN AMERICA.

Very full statistics with reference to the prices charged for gas in the United States have been compiled by the Milwaukee Gaslight Company, and printed in book form. The principal cities are included; and the prices (which are from data received from the respective gas companies) are given for each year from 1885 to 1907 inclusive. The extent of the information afforded may be gathered from the fact that over 160 towns are tabulated. In each case, the figures given are either a uniform price for all gas used regardless of the purpose for which it is employed, or the separate charges made for illuminating gas and fuel gas. In addition to this, there are in so many instances special prices or unusual conditions in force, that no less than 80 of the undertakings have explanatory references accorded to them at the end of the book.

A great amount of trouble must have been expended on the collection and setting forth of the information; but the labour cannot be regarded as ill-spent. Perhaps of more particular general interest is the final table, which contains a list of cities of 25,000 or more population in which gas is being sold in the present year at $1 or less per 1000 cubic feet, for all purposes or for any particular purpose. There are three cases in which the price is 50 c.—Cincinnati, for fuel only, to keep out natural gas (the sales, it is stated, are very small); Detroit, for consumptions over 200,000 cubic feet; and Hamilton, for over 100,000 feet. A price of 60 c. is charged at Detroit, for the second 100,000 cubic feet; at Hamilton, for consumptions of 10,000 to 100,000 feet; at Kingston, for over 100,000 feet; at Milwaukee, for over 20,000 feet; at Racine, for over 30,000 feet for fuel; and at San Francisco, for over 75,000 feet. Under the heading of 65 c., San Francisco alone figures—this charge being made for consumptions of 40,000 to 75,000 cubic feet. At 70 c., we have again Detroit, for the second 50,000 cubic feet consumed; Kingston, for 50,000 to 100,000 feet; Milwaukee, for the second 10,000 feet; and San Francisco, for 30,000 to 40,000 feet. This price is also charged at Toledo for gas used as fuel. The next division—75 c.—comprises the price charged at Cincinnati for light; and there are three instances in which all gas used is supplied at this rate—Cleveland, Duluth, and Wheeling. Thereafter, the sections become longer, until we find that $1 is charged for all or some purposes in 34 towns of the size dealt with in the table.

In the case of New York City, a note is appended that the State Legislature fixed the price of gas at 80 c. per 1000 cubic feet to the public and 75 c. per 1000 feet to the Municipality—such rates to go into effect on May 1, 1906. An appeal from this legislative enactment, alleging unconstitutionality, &c., is now pending in the United States Court. In the meantime, the Companies are charging the public, and collecting, $1 per 1000 cubic feet.

Acting on the recommendation of the Gas Committee, the Newcastle-under-Lyme Town Council have appointed Mr. E. C. Baskeyfield Gas Manager, as successor to the late Mr. W. Winstanley. It will be called to mind that, in May last, it was resolved that Mr. Baskeyfield, who was at the time Secretary to the Gas Department, should have control of the works for the following three months. The salary is £200 per annum, with house, rates, coal, and gas; and Mr. Baskeyfield will be acting as Secretary as well as Manager.

IRISH ASSOCIATION OF GAS MANAGERS.

PRESIDENTIAL ADDRESS

AT THE

ANNUAL GENERAL MEETING IN DUBLIN,

AUG. 13,

By T. J. Reid, of Ballina.

Gentlemen,—In acknowledging for the second time my indebtedness to you for having appointed me your President, I do so not without a certain amount of grim admiration for the custom which has ordained that the Presidential Address should be delivered on the occasion which marks the termination of his year of office, rather than on that which saw his exaltation to high estate. Excellent as this custom is, it bears the impress of slow evolution from the period when the chosen of the multitude harangued his hearers while his honours were yet thick upon him, and his garb of office had not begun to lose that power to induce the mental condition variously described, and which has lately been styled "exaggerated ego." I have no doubt that experience proving how small a ratio such utterances bore to actual performance soon demanded that performance should precede harangue. The wisdom of this arrangement cannot be questioned as ensuring that at least something should be attempted and accomplished which would pass muster against the day of reckoning that such an occasion as this provides. Should my feelings at the beginning of my year of office have been anything such as I have hinted at, you may have the gratification of knowing that they have long since evaporated.

Dealing first of all with the affairs of the Association, and turning to the events which have transpired since I took up the reins of office, the event which calls at once for particular notice is the visit of the Institution of Gas Engineers to this city, and the extremely magnanimous and tactful way in which it recognized our existence and extended to us the utmost and most generous hospitality, of which, I am glad to say, a number of us partook with benefit to ourselves and ultimately, I trust, to the Institution of Gas Engineers, by adding new members to its roll. It could not have been without some good result to be present at the meeting and make closer acquaintance with the men in the forefront of our profession, on whose efforts our welfare and the future of the gas industry may to a large extent depend; for, situated as we are in this country, it is only in the nature of things that we must look to our brethren elsewhere for the essential improvements in our methods which may be regarded as necessary in order that we may retain our present position as the purveyors of light, power, or heat. It is a matter of gratification to me, notwithstanding the fears that were expressed that our meeting would be overshadowed by the Institution meeting—indeed, it had been suggested that we should not hold a meeting this year—to see that so many of our members have formed a higher conception of their duty, not thinking it too great a sacrifice to come here after such a short interval. This is only as it should be; for while we may look to others for guidance and counsel, yet we should allow no consideration to destroy the integrity of our own Association, or admit anything as an excuse for not working out our own salvation in our own peculiar fashion to the best of our ability.

This, I think, is only a proper estimation of our duty to ourselves; and, in this regard, I may be permitted to express the hope that those of our members who are also members of District Associations will see to it that their duty be first of all to this Association, and that no selfish or disloyal motives be allowed to alienate any of that support which would otherwise have been accorded to the Association, or abate for one moment the individual enthusiasm and zeal which every member ought to feel for its welfare. There is nothing whatever incompatible in both Associations pursuing their courses each of mutual support to the other; but occasions will arise when only the practice of a little self-denial will ensure the best interests of this Association receiving premier consideration. I am sure you will pardon my dwelling with perhaps unnecessary persistency on what may be a very improbable eventuality; but a word in time can do no harm, if only it serves to draw attention for a moment to what may be considered a potential source of danger.

Out of this question arises the thought: "What is the necessity for District Associations?" the most obvious solution being that members in a limited area can more readily, and consequently more frequently, meet together to discuss every-day matters which might not be considered of sufficient importance to form part of the programme of the larger meeting. This is all very well. But does not this cause the disqueting suspicion that perchance our Association is not the best adapted to suit the wants of its members, and that the work which it should perform is being relegated to the District Associations? Let us see how far such an insinuation may be true. We have more or less followed on the lines of larger Associations, principally composed, however, of members who are in charge of comparatively large works; and therefore the papers likely to be discussed deal in the main with the more advanced concerns of the gas profession, and so the existence of District Associations for the purpose of mutual help and the discussion of more every-day topics is right and natural. In Ireland, the situation is quite different. The vast majority of our members are interested in works of no great size; and it might be possible that the necessity which evidently exists for District Associations is born from a want, in our failing to supply mental fare suited to our requirements, rather than from a voracious desire for further mental *pabulum*.

Now, I have often considered whether the good accomplished by our Association might not be greatly enhanced, and the proceedings made more interesting and practically useful, by combining the best features of the Central and District Associations—the introduction of discussion on more ordinary topics, the institution of the "Question-Box," the consideration of matters commercial, or any other features that might awaken a more active interest in a number of our members, who, for one reason or another, do not take a sufficiently prominent part in our meetings. The "Question-Box" we may look askance upon; but the mere fact that week after week a portion of the "Gas World" is devoted to replies to queries—not of a very abstruse nature—is proof that information is lacking among some section of the gas profession which the "Question-Box" might supply.

I am not in favour of revolutionary changes, nor am I condemning the work of our Association in the past, which has been excellent, and such as its founders may well be proud of. But it is borne in upon me that a feeling does exist—more or less nebulous, perhaps—that the actual good resulting from our Association meetings is not adequate for the amount of labour involved. Certainly the yearly increasing difficulty our Secretary experiences in getting members to submit suitable papers, and the meagre discussion these papers are accorded, principally from a very limited number indeed of those present at our assemblies, points to the inevitable conclusion that some change is desirable which no mistaken sense of dignity should prevent us making. If we could only persuade those members who are so capable of conducting a discussion through the medium of the Technical Press to reserve some of their efforts for our own meetings, they would not lose any of their value, and would assuredly heighten the interest in our proceedings. We must never get away from the fact that we are a small Association of managers of small works; and, keeping this in mind, we should endeavour not to miss any point which would make the Association indispensable to them.

Nothing in the foregoing remarks takes account of the material advantages which may, and do, accrue from members united in one body, which would be quite reason enough were there no other why every person connected with the management of gas-works in Ireland should consider it his duty to be a member of the Association. Looking over the membership roll, it is surprising to note how many omissions are to be filled up before we can say that all our brethren properly appreciate the good which membership of the Association might do them. Out of about 114 gas concerns in Ireland, there are only some 65 represented in the Association. This can scarcely be considered a fair percentage; and steps should be taken to remedy this state of things. I do not think such apparent apathy arises from selfishness. Perhaps it may be found in some want in our own organization. The majority of the gas-works are small; and, as I have already insisted, it is just among such undertakings that our work must principally lie.

Here let me correct a misconception which seems to exist in the minds of some of the public as to the objects of our Association. They not unnaturally associate them with the ventilation of personal grievances. But possibly, were it more generally understood that our deliberations are entirely directed towards improving our methods, with a view to cheapening and popularizing a commodity of such public utility as gas, they would enlist greater public interest. It is not too much to suggest that we should meet with more appreciation from those interested in gas undertakings, whether as committeemen or as directors, by their seeing that their managers are encouraged to attend our meetings, and are provided with the means of doing so. I also note with regret that very few of the larger works are represented. This is not as it should be; for, even if those concerned harbour the thought that they could reap no possible benefit from membership of an Association where the minor concerns of the gas industry must ever predominate, it is equally true that being in such a position bestows the privilege—which in this instance is not less a duty—of sharing with their brethren who are less liberally endowed some of the fruits of their riper knowledge and experience.

Having dealt with the position of our Association as it commends itself to me, I will now direct my remarks to the ordinary affairs of our profession. Foremost among these I would place the commercial and financial interests, which determine to a greater degree than any other the prosperity or otherwise of our undertakings. Necessity has long forced on small gas undertakings the responsibility of carrying out the supply of gas to the point of combustion. Indeed, we have been involuntary pioneers in the commercial policy now adopted by most large gas concerns in getting into absolute touch with their consumers, and which is forcibly exemplified in the code of rules issued to the Gaslight and Coke Company's fitters, which has as its whole theme the pleasing of the consumer and convincing him that the Company are not wholly concerned in extracting "gas money" from him. These rules are admirable in the case of the Company issuing them, and are suitable for fairly large works; but you will readily

appreciate the feelings of one of our fitters if presented with a copy and told he must conform to such rules. However, it marks the change which the new commercial policy has produced in the attitude of producer to consumer. What is merely a "policy" to others, is a necessity to us. We have so long been called upon to gratuitously perform those little adjustments of burners and repairs of leakages, and the dozen other minor attentions to the consumer's fittings usually expressed by him in the uniform phrase "Something wrong with the gas," that we have come to be held actually responsible by him for every service necessary to the use of gas. We may have often had reason to cavil at the additional burden thus thrust upon us; but I claim that our success is directly attributable to the fact that we have been in the position of knowing and catering for our consumers' wants before they had reached an advanced stage.

Coincident with the life of our Association, and no doubt influenced thereby, a remarkable levelling-up of our works and managers has to be recorded. The improvement in ourselves is perhaps more noticeable than in our works, and, indeed, the totally changed conditions of methods for conveying gas and the various improvements in manufacture demand a much higher order of intelligence than would have sufficed years ago. Furthermore, the manager of a small gas-works in Ireland—owing to the isolated position in which it is placed, and in which he cannot quickly avail himself of more expert assistance—should be a man of greater resource than would be required in a works more favourably situated. The different conditions prevailing in our small towns require the provision of an outdoor department, which in a town of similar size in England might not be so much required, owing to the towns being more self-centred—in fact, embryo cities. The demands upon our resources are of a varied character, as we are called upon to supply the varied necessities of all classes of consumers—including the man who cannot understand why he cannot get gas at the same price as in Widnes.

The mere fact that all the materials which we require in manufacture have to be conveyed such long distances, necessitates our having a commercial knowledge of freights, chartering, &c.; and the actual purchasing of the materials themselves warrants the possession of some business training. In short, in both the manufacturing and selling sides of our smallest concerns the art of buying and selling is a necessary accomplishment. In our manufacturing department a commercial knowledge will be brought to bear on the purchase of the various raw materials and manufactured articles we have to deal with—including such commodities as coal and mantles; while in our selling department how to find the best market for our coke and our tar will test our best efforts, and, indeed, the disposal of the latter within recent years has become a serious problem which is claiming attention from our highest intellects.

Here let me interject that, while we are awaiting the results of tar-spraying experiments on our roads, we may do something to encourage the use of tar as a preservative for the iron roofs which have displaced the timber constructions of other years. I have found by experiment that tar properly applied to roofs of the former material compares favourably with the best paint, and, of course, at much less cost. In recent years, it has become fashionable to paint all our ironwork instead of tarring it. We seem to have the idea that tar as a preservative is out of date, and that if we would preserve our self-respect as well as our holders we must taboo its use. Now, I am not competent to say authoritatively that tar is as good as paint; but we can all point to plant in use for half-a-century still in good condition which owes its preservation to tar. I noted with interest, when visiting one of the large English works remarkable for the low price at which it sells gas, that the æsthetic taste, or whatever it may be, which influences some of us to eschew plain tar had no consideration there, as tar was used as a holder preservative.

In advocating the adoption of a commercial policy in the conduct of our small concerns, I do not for one moment wish it to be understood that it is always wise to embark on wholesale schemes of slot and cooker installations, free incandescent burners, or any of the more advanced methods for increasing consumption. In fact, I would insist that it is often commercially a sounder policy not to touch this sort of thing at all; and at all times we should be chary in adopting schemes of any sort because they are considered up-to-date. A wise discrimination should be exercised in approaching matters of this sort, whether they concern expenditure on our manufacturing or selling departments. Our operations are on too small a scale to cover up any mistakes we may make; but I am afraid that money is often spent on unremunerative work which a sounder knowledge of finance, or a little less seeking after the "bubble reputation," would not have occasioned. In these matters, everyone must judge for himself; and while reasonably enterprising, one should balance any desire to raise a monument to his own ambition (at others' expense) by asking the question, "Would I do this were it my own?"

In any question touching consumers the selling price of gas is, of course, important; and in this respect I think we should not be hidebound by accepted ideas. It is quite a moot point as to whether it is wiser to sell our gas at the lowest uniform rate or adopt differential prices. I am distinctly in favour of differential prices, if only as a means to an end; and I would even go further than this and advocate the adoption of the railway policy of "charging only what the traffic will bear." I have put this into practice by charging a smaller price to slot consumers than to ordinary consumers. This may seem contrary to all common sense; but it is only anomalous when compared with what would be considered good business elsewhere. A low selling price is eminently desirable from all points of view; but I would not set it up as a fetish to be worshipped in preference to all else. It can be easily shown that if a certain financial policy is adopted, it would be possible to sell gas at any price; and I claim that such a policy is not good finance. It is only fair that our income should be such as will pay a decent dividend on the real capital value of our concerns. If this were the case, I wonder how many works in Ireland would be able to maintain their present price of gas. As a matter of fact, as pointed out by our President of last year, Mr. R. Bruce Anderson, in his address, capital outlay has been derived from revenue to such an extent that many of our works are only paying a dividend on their original capital value, and in some cases on even less.

Altogether apart from this bearing of the question, I doubt the wisdom of a low price policy as against a slightly higher price, and looking after the consumers better. We may sneer at the "Given away with a pound of tea" system of gas sales; but observation of human nature in relation to matters of this sort compels me to admit the practical success attending such methods. We must remember that we can only sell a certain amount of gas, no matter what the price is. In our towns with diminishing populations, we cannot look forward to annually recurring increases of 5 per cent., which is the average increase arising from the natural expansion of towns across the water; and therefore sooner or later we must reach the saturation point.

Questions of finance often hinder our progress in the furtherance of those schemes for increasing output to which I have already alluded. The same considerations often stand in the way of the erection of manufacturing plant when doing so would be amply justified were we in the position for raising new capital which is enjoyed by works elsewhere. There is no doubt that there are many gas concerns languishing from the impossibility of raising necessary capital at a fair amount of interest, and must continue to do so until the modern financier comes along and imbues them with new life. It is a dismal fact that it is harder to borrow on the security of an Irish gas-works than were it elsewhere. Both banks and public alike look upon gas investments as unsafe, and would sooner embark their money in some hare-brained scheme to electrify a country side than put a penny into a steady-going concern. Here, again, the capital amount on which dividend is paid is a factor in an unfairly low estimation being arrived at as to the security offered.

Under such conditions, where capital expenditure is paid out of revenue, the enterprising manager, bent on increasing his output, is sometimes pulled up by the tantalizing fact that he must balance his capital outlay and revenue, and stay his efforts for a time, and may never be able to resume them under such favourable conditions. Take, for instance, the case of a works which has been allowed to "run down." The new manager seeks to better things by first of all putting the retort-bench in modern condition; and then he starts to develop the consumption, and finds results successful to the extent that storage capacity is insufficient. All available capital being gone, he must now wait until he has earned the price of a new holder; and thus he has to put a stay on his work of development when it is in need of greater impetus.

There is undoubtedly a splendid field for the investment of Irish money in Irish gas concerns; but if the Irish public continue to await the new era, when everything will be done by the agency of a river, a dynamo, and a bit of wire, they can only blame themselves if English investors, profiting by experience, put their money into our prosaic business. This absolute faith in the possibilities of electricity on the part of our public is one of the things it is impossible to explain. They are quite convinced that it must be cheaper than gas, all evidences to the contrary notwithstanding; and this feeling acts as a deterrent on their gas consumption. Even the visitor to Liverpool will come back with the notion that all the streets are lighted by electricity; and it would be almost impossible to convince him that there are over 18,000 gas-lamps in the city. This is accounted for by the fact that the average visitor to a strange city frequents only the principal streets, where electric arc lamps are in use; and he becomes imbued with the idea that all the streets are similarly lighted, and comes home determined to see his village up-to-date in this respect.

Now this should point a moral for us—that we should make our street lighting the advertisement which it can be if carried out in a thorough manner. To do this it is, of course, necessary that we should have entire control of the lighting, as the average urban authority will not perform the work in the manner we should like. Good lamps of copper—properly designed by a gas engineer rather than by a tinker—are essential. Good incandescent burners that possess more stamina than the usual type are desirable; and, above all, vigorous attention to maintenance. It may sometimes be advisable to do the street lighting at less than cost, so as to preclude the possibility of competition from other sources being introduced, and also to thwart the socialistic aspirations of some of our latter-day urban rulers, who are fond of making the gas question a talking point in their crusade against anything that has dared to exist previous to their time. It is often easier and more expedient to reduce the price for public lighting than reduce the price to private consumers.

Together with the maintenance of street-lamp burners and mantles, something in this way ought to be done for consumers. Indeed, I find it necessary to do all this work free (only charging for materials), as the average consumer will not trouble to give attention to his incandescent burners; nor does he possess the knowledge which such attention requires. This want of knowledge is not confined to the Provinces. When last in Dublin I entered a chemist's shop in a principal thoroughfare and found the air supply to a "Block" burner covered with stamp paper. I trust that Mr. Cotton will forgive me for having adopted the rôle of his fittings inspector for the nonce, in showing that dispenser of drugs that the gas-adjusting nipple was screwed home, and suggesting that the headache of which he complained was due to his want of acquaintance with the principles of the bunsen tube rather than from "bad gas" meted out to the unfortunate citizens of Dublin.

Having devoted so much time to the commercial side of our business, I cannot say as much as I should like regarding the manufacturing side, and can only touch on a few phases of the subject. Before doing so, however, I wish to make a few remarks regarding the coal question, which, always an important one, has this year assumed alarming proportions. The phenomenal rise in price which ushered in the spring most of us fancied would give way as the summer advanced. But, unfortunately, this has been otherwise; and, I dare say, most of us have contracted at advances of 2s. 6d. to 4s. per ton on last year's prices. This means a very serious situation indeed, only lessened by the knowledge that the increase does not bear as high a proportion to our selling price of gas per 1000 cubic feet as would be the case were we nearer the pits.

Into the various causes assigned for the increase in price it can do no good to follow. It matters not to us whether this has been occasioned by better trade in England and Scotland, which we have so often to philosophically accept as a sufficient reason for advances in all sorts of goods, the while we vainly wish we were sharing in the enhanced gas sales which such brisker trade engenders, or whether a large foreign demand following on the abolition of the coal-tax has put up the price. But we in Ireland would be more than human did we not indulge in the socialistic hope that such an important national asset should be under State control, with universal rates to all parts of the kingdom.

Leaving on one side the matter of coal prices in this abnormal year, I think the whole question of coal purchase demands serious and concentrated attention on the part of the gas industry as a whole. Most of us have to complain of the manner in which the term "screened" is interpreted by collieries when applied to gas coal. It would appear that this is not quite the same when house coal is signified, and would lead to the conclusion that house coal is better screened than gas coal. At all events, the amount of slack which reaches us cannot be accounted for in any other way than by assuming that the screening was not so effectively done as it might be. The fact, too, that it is impossible to buy unscreened gas coals of good coking qualities may be important as shedding some light on this matter.

I think there might, with advantage, be more reciprocity among gas concerns in all such matters as buying and selling. We see combinations effected in the firms supplying all our various requirements, and it cannot be imagined that our interests were wholly considered. It would not therefore be too much to assume that whatever advantages accrue to suppliers from combination might equally be experienced by gas concerns, as purchasers, adopting similar methods. There is far too much aloofness in the commercial relationship of gas concerns one to another. The manager who will go out of his way to give his brethren the benefit of any improved manufacturing methods he may have discovered, will jealously guard information of a commercial nature which might be of considerable benefit to others, the disclosure of which could not be detrimental to himself or the interests with which he is charged. In countless ways would the cause of the gas industry be furthered and strengthened were we all united. There are few industries of the magnitude of ours which have not combined in some shape or form to maintain their position. In this respect we have lagged behind; and it is high time that whatever stands in the way should be brushed aside, and so allow the primitive sentiment of self-preservation to receive due consideration.

Slack or small coal is being largely used in many works favourably situated as regards carriage from the pits, which latter consideration precludes its use in our works. It is possible, however, to purchase slack at from 7s. to 10s. per ton from local coal merchants; and in this way I am able to use about 30 per cent. of slack with satisfactory results.

A great many of the improvements which have been made in gas-works practice have had some connection with improved carbonizing methods. Many of these can only possess academic interest for us. The installation of any kind of machinery except of the simplest description is beyond us, and the shovel and the barrow must still retain their position. It is for this reason that the changes in our retort-houses are few, and mainly consist in improved settings on the regenerative or generator system, which can, with advantage, be installed in the smallest works. I do not think the perfect shallow-type setting has yet been designed. Of course, it is not expected that as low a fuel-consumption can be attained with shallow as with full-depth settings; but the chief difference, to my mind, is the much greater wear and tear in producers and ironwork of the former type, and the greater amount of clinkering necessary. It may be that the future development of the vertical retort—combined, perhaps, with some method of using the heat of the issuing coke in the production of water gas—may give us the opportunity of making radical changes in our retort-houses.

In our small operations the number of retorts in a setting is important, considered in relation to our maximum make; and it often occurs that an additional retort in a setting would obviate the necessity of keeping two beds in action. Again, the number of retorts in action decides the minimum storage which will suffice; and often the keeping of another setting in action may be justified by the gas storage that is required. These considerations must be weighed together, and only possess importance in works where one retort more or less affects the situation materially. The improvements in our works may not be so noticeable to those who only know them as they are; but, contrasted with what they were twenty years ago, they show considerable advancement. Time was when a small gas-works was an ideal place to enjoy complete repose—a veritable garden of sleep, where the stoker only dissociated himself from the coal heap to put in an occasional charge, and the manager was only awakened into energy when the holder was low. The amount of heat then produced was in contrast to the unaccountably low heat of the retorts. The only animated period of the day was the evening, when the retort-house became the Local Parliament, where discussion sometimes ran high, and the charging shovel and clinkering bar were introduced to drive home some argument. But those times are gone, and only the associations remain. Our works are now generally well equipped to meet the increased demand we have all experienced; and the period of animation extends to every hour of the day and night.

We are all anxious, of course, to show a good yield of gas from our coal; and in trying to obtain such result we have doubtless experienced the disastrous effect of "stretching" the make by maintaining too great a vacuum in our retorts. Now, as to the wisdom of deliberately admitting producer gas into our holders, I am not quite prepared to give a definite opinion; but as a compromise I would admit the advisability of maintaining a slight vacuum in our retorts. In doing so, we may possibly cause small quantities of producer gas to be drawn in, but we also prevent the leakage of a similar quantity of coal gas, which would have occurred had there been the same amount of back-pressure instead. Therefore, our make gains to the extent of the added amounts of coal gas saved and producer gas admitted. Consequently, I am prepared to admit the advisability of the introduction of producer gas to the extent which ensures that no coal gas has been lost through the pores of our retorts—which ideal conditions are only obtained by strict attention to the hydraulic main and the exhauster. Latterly, a governor has been introduced on the foul mains, to correct irregularities in the work of both. While not taking up a decided position on this question of "coal gas *cum* producer gas," I do not think the storm of pious wrath which greeted its advocacy was altogether justified. It appeared to me that its opponents' sense of morality did not allow them to judge of its merits as a manufacturing process. The objections urged against it on moral grounds were not very clearly defined. They were chiefly based on an imagined injustice to the consumer; and I must openly confess to a moral obliquity which renders me incapable of seeing exactly where this injustice was. If we take up our position as suppliers of light and heat, it seems to me that the real test is the cost at which we can supply these to the consumer; and it is fatuous to argue that an injury is being done him because of the medium through which this is effected. The consumer is only concerned in the price at which he obtains light and heat, other things being equal.

I may here relate an experience I had during a period of flood, when the water reached over the fire-bars of a generator setting, the retorts of which were in a very leaky condition. Retiring to rest in the very early hours (after an anxious night, with spirits as low as the heats and holder), I gave the stoker strict instructions to "have the holder up somehow." He carried out his instructions certainly, as on rising I found the holder "blowing." With some misgivings, I went to the "photometer," which, in our case, is an incandescent burner adjusted to the conditions which prevail in the consumers' houses, and found that the light was very good indeed. On reckoning up the make per ton, this totted up to—well, I think I had better not state it, but it was a record. What I surmise happened was this. The stoker kept the exhauster "pulling," thus introducing producer gas and also possibly water gas into the leaky retorts; and these mingling with the high-grade gas there produced resulted in this phenomenal make. Could I reproduce the same conditions, I would have no hesitation whatever in supplying such gas at all times; but, unfortunately, I can only regard it as one of those accidental liftings of the veil which conceals from our view the hidden mysteries of science.

Perhaps the most important and least understood piece of apparatus in our works is that "cabinet of mysteries" the hydraulic main. Yet there is no other portion of our plant which better repays close attention, begotten of a correct appreciation of the principles underlying the work required of it and the conditions which prevail therein during the various stages of working; and this quite apart from the ordinary mechanical operations of flushing-out the main frequently. In how many works is even this primary necessity recognized and carried into effect?

Possibly the inconvenient position in which the hydraulic main is placed, and the unpleasant conditions usually associated with the top of retort-benches, has something to say to the closer acquaintance that is so desirable not being formed; and it would be well, when extensions are being planned, that greater facilities for easy access and inspection are not neglected. This need not extend to the provision of those promenades, positively alluring in their luxurious proportions, observable in photographs of large retort-benches recently constructed. All that is required is to make the spending of a few hours on this too little frequented portion of our domain a trifle less purgatorial.

The foul main also is more deserving of being allocated a higher position in our estimation than merely being regarded as a connection between the hydraulic main and the condensers, as its stunted and attenuated appearance and primitive construction in some of our works would seem to imply. Properly constructed, the foul main is capable of performing most important functions in the earlier processes of purification; and, judiciously worked, it is capable of eliminating to a considerable extent those naphthalene worries which are the source of so much trouble and expense. This has been my experience where the gas is caused to travel slowly along with the hot tar and other liquids through a foul main 18 inches in diameter. It is important, however, to remove the liquids before their temperature falls below a certain degree. By doing so, we retain in the gas the lighter hydrocarbons which would otherwise have been absorbed by the tar.

Now, I am not writing an essay on gas-works management and construction, although you may have some grounds for thinking so. I cannot say anything here regarding the other processes in our works. I will merely remark that the use of an exhauster is now considered desirable even in the smallest works; and where this is the case I would recommend some type of mechanical washer. It is a matter for wonder to me that, in a country where natural oxide is so easily obtainable, more use is not made of it as a gas-purifying agent. Possibly the fact that our purifying boxes are too small, restricts its use; but I should say that the resulting economy would well repay the expense necessitated by putting in larger purifiers. It is necessary, of course, that the purifiers should not be called upon to eliminate impurities which should have been treated elsewhere; and it is well not to emulate the condition of one works I know of, where the solitary purifier was also the tar-extractor, liquor well, and exhauster (of patience) all combined. Amid such divided duties, legitimate purposes for which a purifier is intended are likely to suffer in the performance.

Little change has to be recorded in our distribution system or methods, if we exclude the sending out of our gas at higher pressures than formerly. Higher pressures are now desirable, and, indeed, necessary. Pressures of 3 inches or 4 inches are very ordinary; and I cannot trace that leakage is greater in consequence. The introduction of steel mains in our distributing systems is the only departure from the methods instituted more than half-a-century ago; and there can be no doubt that they possess qualities of such merit as will make them in many places to be preferred to cast iron. Considerable attention has been devoted to the method of jointing these mains; and the latest method—known as the "Anderson" joint—would appear to combine the best features of the rigid and flexible joint.

In bringing these remarks to a close, I must apologize for the somewhat tentative manner in which I have dealt with matters of importance, and the length of my remarks devoted to matters of smaller moment. I make no claim for any great originality of thought which would throw a new light on any branch of our profession. Many details, I have not touched on at all. But they have all at one time or other received due attention from others; and, indeed, anything I have said has been better said repeatedly by other holders of this office. Your Prisident of two years ago, Mr. Airth, pointed out the importance of little things, which in the aggregate assume great significance; and it is to the small gas-works manager I have addressed my remarks, as befitting one whose work has been performed and experience gained in such works. It is because I know—none better—the great difficulties we are confronted with, situated as most of us are in a business sphere, with its horizon of such circumscribed limits, where we can never experience to the fullest extent the spirit-lifting effect which the successful accomplishment of things inspires, that I abjure you with all the insistence possible not to allow this to lessen your interest or despise the work of your own hands. It is well sometimes to take an impersonal view of our work; and we should cultivate the faculty of getting outside it, so to speak. We ought not to be specialists or only capable of thinking in five places of decimals. Let us not forget there is a dignity attaching to small things rightly considered. Make certain we do nothing to alter that, either by taking too low or too high a conception of our position. Do not be ashamed because of the size of your works. You cannot estimate a man's worth in millions of feet or by the number of lifts in his holder. You must be able to take off your coats and get right down to work, and yet resume your position as manager without losing your proper perspective.

There must inevitably be something in my remarks with which you cannot agree. It is, indeed, difficult to resist the temptation which immunity from criticism secures to the presidential address. My sincere desire, however, was to say something at least which would make for the solidarity of the gas industry in Ireland and the welfare and usefulness of the Irish Association.

OBITUARY.

The recent death is announced of Herr E. Windeck, at the age of 57 years. He was in turn Manager of the gas-works at Bochum and Schalke in Westphalia; but in 1888 he started in practice as a Consulting Gas Engineer in Cologne, and was the representative in that city of the Berlin-Anhalt Engineering Company. He was a very active member of German technical (gas) institutions.

We regret to record the death on the 29th ult., at the early age of 35, of Mr. Frank Parsons, the Secretary and Manager of the Rowley Regis Gas Company. Deceased had been suffering for some time from an incurable disease, but was able to leave his house a few days before his death. Mr. Parsons was the son of the late Mr. J. H. Parsons, for many years Manager of the Oswestry Gas Company. After serving an apprenticeship to a firm of mechanical engineers, he was for two years with Mr. William North, at Stourbridge, as Assistant and Draughtsman; and prior to obtaining the appointment at Rowley Regis, he was Manager of the Cefn Gas-Works. He was highly respected by his Directors, by his brother Managers, and by all with whom he was associated. He held the Honours certificate for "Gas Manufacture," and a number of first-class certificates for science subjects obtained at South Kensington. He leaves a widow and two children.

As the result of a long illness, which, however, had only lately confined him to the house, Alderman Thomas King, J.P., a Director of the Portsmouth Water Company, died at his residence in the borough early last Tuesday morning, in his 67th year. Deceased was a member of a well-known firm of local auctioneers—Messrs. King and King—which he joined in 1863; and his capacity for business was largely instrumental in bringing the concern into its present prosperous condition. In 1884 he was elected a Director of the Portsmouth Water Company, and subsequently of the Water-Fittings Company. In 1886 he entered the Town Council, and was Chairman of the Watch and Sanitary Committee at the time of his death. In 1894 he was elected to the position of Chief Magistrate, and the following year was elevated to the Aldermanic Bench. During his Mayoralty, the Italian fleet visited Portsmouth; and in recognition of the welcome he gave them, he was the recipient of an Italian decoration. He was also made a Justice of the Peace for the borough. Deceased was regarded as one of the makers of modern Portsmouth; and he has left his mark upon it for all time. Referring to him last Tuesday, the Portsmouth "Evening News" said: "Enjoying the fullest confidence of his colleagues and the esteem of all his fellow-citizens, he has gone down to death truly and deeply mourned."

The "Water Arbitration Prize."

The Institution of Mechanical Engineers have received from the Metropolitan Water Board and Sir Edward Fry, the Chairman of the Court of Arbitration under the Metropolis Water Act, 1902, two sums of £250 each, which the donors desire to be used for some engineering purpose connected with the Institution. The Council have invested the amount (£500) in a trustee security, the income from which they have decided, after consultation with Sir Edward Fry, shall be offered biennially for some paper submitted in accordance with prescribed conditions. It has been further decided that the prize shall be known as the "Water Arbitration Prize," and shall be offered for a paper on an engineering subject to be announced by the Council one year before the time for sending in the papers. The prize, which will have a value of approximately £30, will take any form which the Council may from time to time decide upon, and will be accompanied by a certificate bearing the seal of the Institution. If, in the opinion of the Council, no paper of sufficient merit be received in reply to any particular offer of the prize, the amount available for the award will be added to the capital of the fund. The conditions for the first award, to be made in 1908, are: (1) The award will be made to the author of the selected paper dealing with the filtration and purification of water for public supply. (2) Members, associate members, associates, and graduates of the Institution may compete. (3) Papers must be sent in to the Secretary of the Institution of Mechanical Engineers, and must reach him not later than Jan. 3, 1908. (4) Each paper must be clearly written, or type-written, on one side only of foolscap paper, with a margin, and must be accompanied by an outline or synopsis of its contents of not more than 600 words. Illustrations submitted with the paper must be properly drawn to scale. (5) Papers submitted for competition will become the property of the Institution, and, at the discretion of the Council, may be either read and discussed at a general meeting or printed in the "Proceedings" without having been so read and discussed. Each paper must consist of original matter written by the competitor himself, and the Council will require a written statement to this effect. Any paper not accepted for printing in the "Proceedings" will be returned to the author. No paper which has been previously published will be accepted for competition.

Mr. John G. Holmes, of Belmont, Chester, J.P., a Director of the Chester Water Company, left £58,145.

THE CENTENARY OF GAS LIGHTING.

(*Continued from p.* 385.)

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In 1870, owing to the sudden illness of Mr. Esson (the eminent Gas Engineer previously mentioned), who was at this time President-Elect of the British Association of Gas Managers, Mr. Magnus Ohren was unexpectedly called upon to fill the office of President of the Association. In his Inaugural Address, he dealt chiefly with the question of sulphur compounds, and said:

> Gas can be made practically free from impurities; and it is but right that the consuming public should have pure gas to burn, especially now that chemical science has shown us the way to free our gas from these impurities which thirty years ago we supplied with the gas, because we had not then the knowledge required to grapple with those difficulties. About that time, with gas at 10s. per 1000 cubic feet, I remember perfectly well, when testing gas for sulphuretted hydrogen by means of acetate of lead—the only test for sulphur known to the gas engineers of that day—I often found the test of a shade which, if found in the gas of the present day, would make Dr. Letheby's hair stand on end with horror at the amount of impurity. Mind, I am giving you my experience of thirty years ago, when I was a pupil of the engineer of one of the London Gas Companies. Chemical science has, however, made vast strides since then; and the case is very different in the present day. Gas can now, and should be, served out to the public free from visible sulphuretted hydrogen and ammonia.

This statement was followed by two papers on "Purification," one by Mr. Upward, of the Chartered Gas Company, and one by Mr. George Livesey, of the South Metropolitan Gas Company, on "Scrubbers," who explained an admirable arrangement by means of thin boards placed edgeways tier above tier, which he had used at his works, and which he said was very effective, never got out of order, and never wanted changing. Mr. John Ohren, of the Rio de Janeiro Gas Company, substituted plates of iron for trays of coke, with good effect.

It was at this time that the first mention of the "Iron Stoker" was made, in a paper by Mr. Somerville, of Dublin, who gave his additioual experience of Best and Holden's "Iron Stokers." Mr. Magnus Ohren said he had seen the one at Dublin at work; and he also called attention to the "Iron Stoker" produced by Messrs. Dunbar and Nicholson for drawing and charging single retorts. He mentioned, too, an "Iron Lamplighter." Mr. Price's apparatus was described, also two additional lamplighters—the hydraulic lamplighter and the pneumatic lamplighter, the first designed by Mr. Hunter.

The address also dealt with the endeavours made to lighten Sunday labour, by Mr. Morton, of the London Gas Company, and Mr. Livesey, who introduced the principle. To show that there is "nothing new under the sun," it may be pointed out that Mr. Ohren referred to a paper read before the Association on "Tar Pavements," by Mr. T. H. Methven, of Bury St. Edmunds. But the most interesting item in the address was the allusion to the introduction of gas-cookers; Mr. Somerville, of Dublin, having first brought them into use at Maidstone. So satisfied were the consumers with them, that they were taken faster than he could make them; and his summer consumption of gas was largely increased.

In 1872, Mr. C. Heisch, remarking on what was being done in the way of improved gas purification throughout the country, said: "Experience shows that a much lower maximum than 20 grains of sulphur is obtainable; and processes are being employed in some gas-works in the country which, if all we hear be true, enables gas of unprecedented purity to be supplied from works situated in densely populated places, without creating the least nuisance." He asked, "Why is the Metropolis not to have the benefit of these improvements?"

In 1876, the sliding-scale, the auction clauses, and a standard price were introduced into the Gaslight and Coke and South Metropolitan Companies' Acts. A standard price was fixed, and also a standard dividend of 10 per cent., which could be raised 5s. per cent. per annum for every 1d. taken off the price per 1000 cubic feet. This 10 per cent. dividend was to be reduced proportionately if the Companies increased the selling price above 3s. 9d. and 3s. 6d. respectively. Under the new conditions of parliamentary regulation and control, the companies were given an interest in reducing the price of gas by this two-way sliding-scale, which made the dividends depend on the prices charged to the consumers, and vary inversely with them. With such a system, high dividends would mean cheap gas; and the interests of the companies and the consumers would be absolutely identical.

London cannot claim to be the originator of the sliding-scale. It had already been put into the Sheffield Gas Company's Act in 1866, and in the West Ham Company's Act of 1869; and in 1874, at a meeting of the British Association of Gas Managers, Sir George Livesey warmly dealt with the question, and strongly advocated an up-and-down unlimited scale, giving an increase of dividend for every reduction of price below, and making a decrease for every rise of price above, a fixed limit. Thus, as far as London is concerned, Sir George Livesey may be termed the father of the gas companies' sliding-scale.

Sir George Livesey, in speaking of this at a later date, says of his introduction of the sliding-scale: "Strange to say, all the Companies, mine included, refused the sliding-scale in 1875. Except the Commercial, the whole of the Companies were against me. Lord Grimthorpe, then Sir Edmund Beckett, who was Counsel for the Companies, in one of these [Parliamentary Committee] rooms, referred to me as 'this traitor; this Queen's Evidence.' Twelve months later, they came for the sliding-scale. My own Board were divided; three were in favour, two against, and so they went with the rest. Then those Companies I mentioned came to Parliament and applied for the sliding-scale."

The object of the sliding-scale was to secure "due care and management" on the part of the companies, by giving them (as the letter of the Board of Trade to Mr. James Beal of the Metropolitan Municipal Association in 1874 stated) a strong interest to reduce their expenditure—the "strong interest" being the power to divide more than 10 per cent. According to Mr. H. E. Haward, of the London County Council, the "sliding-scale has enabled the three London Companies to divide ever-increasing dividends, over and above the 10 per cent. to which they were originally entitled. In no year since 1875 have the dividends fallen below 10 per cent. On the contrary, the dividends to which they have become entitled have most continuously risen. The South Metropolitan Company, with gas at 2s. 1d., are entitled to divide no less than 14¼ per cent.; the Commercial Company, with gas at 2s. 6d., can divide 13¾ per cent.; while the Gaslight and Coke Company, with gas at 3s., can divide 12¼ per cent." "During the period from 1876 to the present," says Mr. Haward, "the three Companies together have distributed upwards of £3,000,000 extra in dividends in respect of capital on which they were formerly allowed only 10 per cent. This bonus may be safely said to be the price which the consumers have had to pay for any benefit which may have accrued to them under the sliding-scale." It should not be forgotten, however, that for the shareholders to get these dividends under the sliding-scale, the consumer would be securing cheap gas, out of proportion to the amount received by the shareholders, as will be seen from the following table (compiled by Mr. Haward) showing the Companies' and the consumers' shares in the increased profits under the sliding-scale at per £100, in 1876 and 1898:—

—	Companies.				Consumers.			
	1876.		1898.		1876.		1898.	
	Amount.	Proportion.	Amount.	Proportion.	Amount.	Proportion.	Amount.	Proportion.
	£	Per Cent.	£	Per Cent.	£	Per Cent.	£	Per Cent.
Gaslight and Coke Company	9511	17·7	14,806	14·5	44,088	83·3	87,406	85·5
South Metropolitan Company	3615	23·8	5,600	12·6	11,524	76·2	38,637	87·4
Commercial Company	1529	24·9	1,877	16·1	4,623	75·1	9,756	83·9

Thus in 1898, 85·5 per cent. went to the consumers and 14·5 per cent. only went to the Company on the north side of the river, and the same proportion practically on the south side; so that as consumption increases in a greater ratio than capital, so it will take more to reduce the price 1d., with a corresponding decrease in the amount to be received by the shareholders.

As to the auction clauses, the surrender of the privilege of allotting all new capital rateably at par among the existing shareholders was a concession, seeing that for many years the shares of the Companies were at a high premium, so that all new stock was issued below its actual value. The fortunate shareholder could then either keep his allotment, and continue to draw his 10 per cent., or dispose of it at the market price and reap an enormous profit. The shareholders were then, one can well understand, very loth to receive this new arrangement, which made all new capital go to auction. The old system meant that every penny raised by the Companies had to pay 10 per cent.; and though it was a very nice plan from a shareholder's point of view, yet the gas manager has come to see the arrangement from quite a different aspect—viz., capital charge.

There was still one Metropolitan Company without auction clauses in their Acts—the Commercial Company. These clauses were not inserted in this Company's Act of 1875. "Treated," says Mr. H. E. Jones, "with some favour by Mr. Forster's Committee in 1875, because they took the sliding-scale when the other Companies refused it that year, Mr. Forster in consideration did not impose the auction clauses upon them."

The standard price fixed for the three Metropolitan Companies at this date was: The Gaslight and Coke Company, 3s. 9d. per 1000 cubic feet; the Commercial Company, 3s. 9d.; and the South Metropolitan Company, 3s. 6d. There was no limit the Companies might not charge up to, providing they were willing

to sacrifice ¼ per cent. dividend. per 1d. charged; nor was there any limit downwards. The more they decrease the price, the greater is the amount they can share, until we see the South Metropolitan Company dividing 4 per cent. above their statutory amount, because they have reduced their price 1s. 4d. below the standard of 3s. 6d. In 1880, the selling price of the Gaslight and Coke Company was 3s. 4d., of the Commercial Company 3s. 3d., and of the South Metropolitan Company 3s.; and we find the South Metropolitan Company amalgamating with the Phœnix Company, whose selling price was 3s. 4d., and with the Surrey Consumers' Company, whose price was 3s. 9d.

Thus an end was brought to a long period of agitation, conflict, and trouble, extending over 28 years (from 1848 to 1876), during which period, arranged areas, fierce competition, authorized districting, amalgamations, and statutory monopoly had all taken part; and now, just when the Gas Companies were working in harmony, and competition and agitation had ceased, a fresh form of competition sprang up, in a new illuminant—electricity—which caused almost as much wonder as gas lighting in its early days. In 1880, the Jablochkoff Company (a French Syndicate) lighted up the Holborn Viaduct experimentally. It is interesting to note that a lamplighter was present each evening, from sunset to midnight, of the three months the experiment was running, to light up the gas-lamps when the electricity failed, and that his services were necessary. After three months' trial, it was found that the sixteen lamps cost £10 per night, against £1 7s. 1½d. for gas; or 10s. 7d. per lamp per hour, while the cost of a gas-lamp was but 0·27d., or little more than ¼d. Taking the charge per annum, electricity cost £3072 against £419 for gas, for this small area; and as the former light came to about 7½ times the cost of gas, the experiment was abandoned.

Electric lighting experiments went on in various parts of the Metropolis, and direful pictures of the downfall of the gas industry were drawn. In 1884, Sir W. H. Preece, the Engineer to the General Post Office, reported on experiments made with Edison and Brush lamps in London; and in 1885 Mr. Haywood made an interesting report as to the Municipality supplying electricity itself, in which he mentioned the complete stagnation in electrical enterprise in England attributable to the operation of the Electric Lighting Act, which "fettered the industry in a variety of ways." In the end, he was entirely against the Municipality supplying electricity itself, but he advised that it should encourage commercial enterprise. In 1883, Sir W. H. Preece, reporting on the electric light experiments, stated that though the streets of London were fairly lighted by gas, it had been proved, both by gas and electrical interests, that the illumination can be very materially improved; and his opinion was that, for street illumination, all the conditions could be obtained as well by gas as by electricity.

In spite of adverse criticism, experiments proceeded with this new form of lighting; and the Thames Embankment was lighted by Jablochkoff lamps. Later on, companies sprang up all over the country, and municipalities applied for Electric Lighting Orders, and commenced to light the streets with arc lamps at great cost. It was at this time, when gas companies throughout the kingdom were being "hard hit," that the wonderful invention of Dr. Auer Von Welsbach (who received the Institute gold medal), the incandescent gas mantle, was brought to the notice of the world; and although its price in this country (1s. 3d. each) and fragility, coupled with prejudice, and a certain amount of hesitation on the part of the gas companies, retarded its adoption for some time, it was found, on account of its cheapness by reducing the consumption of gas and giving three or four times the illuminating value, to be a very serious rival of the incandescent electric lamp for indoor purposes.

(*To be continued.*)

Mr. W. Harry Blakey, Assistant-Engineer to the York Gas Company, has been appointed Gas-Engineer to the Corporation of Morecambe, in succession to Mr. J. R. Duff, who has obtained the position of Manager and Assistant-Secretary of the Banbury Gas Company.

As usual on the occasion of the annual meeting of the British Association, the social side was by no means neglected this year. As our readers are aware, the meeting was held at Leicester; and the Local Secretaries were Mr. Alfred Colson, M.Inst.C.E., the Engineer of the Gas and Electricity Departments of the Corporation, and Mr. E. V. Hiley, the Town Clerk. The local Executive Committee, of which Mr. Colson was Chairman, have been heartily congratulated on the success of their efforts to secure the comfort and enjoyment of the members and visitors.

On behalf of a Commission appointed by the French Minister of Public Works, M. Le Gavrien has reported on the means adopted to prevent dust on roads. According to the Engineering Supplement to "The Times," M. Gavrien considers the various systems in use may be dealt with in four categories: (1) Tar spreading (employed hot or cold), (2) applying petroleum, (3) watering with various dissolved mixtures, (4) sundry processes which do not come under any of the above heads. While the first three divisions need little explanation, the author notices under the fourth head certain systems of forming roads which will not give rise to dust, such as the use of concrete or asphaltic mixtures. In his general conclusions, he speaks favourably of the use of tar, and he mentions as "palliative" processes the employment of petroleum and certain solutions analogous to Westrumite.

ENGINEERING QUESTIONS AT THE MEETING OF THE BRITISH ASSOCIATION.

At the recent meeting of the British Association in Leicester, various interesting subjects were brought forward in the Engineering Section, the President of which was Professor Silvanus Thompson, F.R.S.

SCIENCE AND ENGINEERING—TRAINING OF ENGINEERS.

In the course of his Presidential Address, Professor Thompson referred to the development of engineering and its foundation on science. He said we lived in an age when the development of the material resources of civilization was progressing in a ratio without parallel. Everywhere we saw this ever-increasing development. We lived and worked in larger buildings, we travelled more, and every year there was springing up a greater demand for raw materials and products. We must not delude ourselves with imagining that the happiness and welfare of mankind depended only on its material advancement, or that moral, intellectual, and spiritual forces were not, in the ultimate resort, of greater moment. But if the inquiry were propounded what it was that had made possible this amazing material progress, there was but one answer, and that was science. Chemistry, physics, mechanics, mathematics—these had given to man the possibility of organizing this tremendous development; and the great profession which had been most potent in applying these branches of science to wield the energies of Nature, and direct them to the service of man, had been that of the engineer. Without him there would have been little of this activity; and without mathematics, mechanics, physics, and chemistry, where would have been the engineer? The difference to be found in the social and industrial conditions to-day and those of the pre-Victorian era were due not in any appreciable degree to changes in politics, philosophy, religion, or law, but to science and its applications.

Professor Thompson went on to say that in engineering, above all other branches of human effort, they were able to trace the close interaction between abstract science and its practical applications. People were assured that research in pure science was bound to work itself out in due time into technical applications of utility, and that the pioneer ought not to pause in his quest to work out potential industrial developments. Yet, admitting all this, it still remained true that in this thing the temperament of the discoverer counted for something. There was still another aspect of the relation between pure and applied science—viz., the reaction upon science and upon scientific discovery of the industrial applications; for while pure science bred useful inventions, it was none the less true that the industrial development of useful inventions fostered the progress of pure science. The history of electric telegraphy furnished a very striking example of this reflex influence; and in the history of the development of electric motive power they had a striking example of the interaction of science and industry. In 1857 electric motor power was thought impossible. Now, however, the electric motor was considered a gigantic success; and the reason for this astonishing revolution was the action and reaction of pure science. Pure science furnished a discovery; industrial applications forced its development; this development demanded further investigation, which in turn brought about new applications.

Turning to the subject of the education and training of engineers, Professor Thompson remarked that here, too, the interdependence of science and industry was recognized. Recent years had brought about a so much better understanding of education, that one seldom heard a practical man denouncing theory, or the theorist pooh-poohing practice. As a result, distinct progress was being made in the training of engineers. Knowledge perfected by study must be infused into the experience gained by practice, otherwise competition with systematically-trained workers of other nations was very unequal. The mental training most needed for the great majority of engineering students was that which would enable them to think in physics, in mechanics, and in geometric space, not in abstract symbols. One evidence of the wholesome change of opinion that was springing up concerning the training of engineers was the abandonment of the system of taking premium pupils into works with no other test or qualification than the money-bag. Premium pupilage was absolutely unknown in the engineering firms of the United States or on the Continent of Europe. The firms who had abandoned it were finding themselves better served by taking the ablest young men from the technical schools, and paying them small wages from the first, while they gained experience and proved themselves capable of good service. The premium pupil system had been weighed and found wanting, for two things clearly stood out—that the young engineer must be college-trained, and that when he went to work he should be regularly paid. If the institutions, schools, and colleges where engineering training was offered were but rightly developed and co-ordinated, the engineers of Great Britain need have no fear as to holding their own against the trained engineers of other countries. It was for the employers to make use of these institutions, and to show that sympathetic interest in their efficiency which was essential to their full success. A most important contribution to this question, which affected the whole future outlook of engineering generally, was the report of the Institution of Civil Engineers on the education and training of all classes of engineers. The

findings of the Committee of the Institution must, Professor Thompson thought, be received as the most authoritative pronouncement of the most competent judges.

THE PRESENT POSITION OF GAS AND PETROL ENGINES.

Mr. Dugald Clerk read a paper on "The Present Position of Gas and Petrol Engines." He said that at no previous time had gas and oil engine builders had so many orders in hand, and never before had these motors been applied so successfully to so many different purposes. The larger part of the gas-engine industry was occupied with motors of less than 100 H.P. per cylinder; and the turnover in Britain of such engines was at the rate of some 300 engines per week. It was generally recognized that these engines were as reliable as the best steam-engines of similar dimensions, and much more economical in fuel consumption. The smaller engines used coal gas; and the larger ones, producer gas generated in modern suction gas-producers using anthracite for fuel. Large gas-engines of English design had been built by the Premier Company, Messrs. Crossley Bros., Limited, and the National Gas-Engine Company. English designers had always felt the desirability of keeping down cylinder dimensions as much as possible; and Continental designers had recently shown a strong tendency to follow them. The large gas-engine really presented two distinct problems—the first to build engines of great power which would continue to run effectively and economically for long periods without breaking down; and the second to build them at a price sufficiently moderate to enable the engines to effectively compete with the large steam-engines in the matter of first cost. Personally, he did not believe that sound and continued commercial success could be looked for with really large gas-engines until some better solution had been found for their present constructive difficulties.

Apart from the questions of the engines themselves, Mr. Clerk said there were difficulties which prevented the equal competition of gas-engines with steam-engines for powers greater than (say) 400 or 500 H.P. Coal gas was too expensive a fuel for large engines. Producer gas effectively met the wants of medium-sized engines up to 200 H.P.; but the cost of anthracite handicapped engines of larger size, and equal competition would not be possible until better bituminous fuel producers were designed than those at present existing. The work on the Continent had not aided the solution of the bituminous fuel producer problem. Practically all the large Continental gas-engines were operated with blast-furnace gas. Some success had been attained in Britain as the result of strenuous and praiseworthy efforts by Dr. Mond, Messrs. Crossley, and others; but it could not yet be said that an entirely satisfactory bituminous producer had appeared. In his view, no such producer could be considered really satisfactory until it attained simplicity, lightness, and the fewness of parts of the anthracite suction producer which now formed so large a British industry.

The author went on to remark that the large gas-engine might be considered as combining the difficulties of hydraulic engineering work at considerable pressures with those proper to a boiler furnace or flue. Thick castings were required to stand the high pressures; but to allow free heat-flow from the flame within the cylinder to the water in the water-jacket called for thin castings. Though much ingenuity and skill had been spent in this direction, it was found that a dimension limit was very soon reached; and cylinders of 51 inches diameter were found to be too large. There were several ways of reducing temperatures and maximum pressures without reducing mean pressures; but all required much more accurate knowledge of the properties of the working fluid than was at present possessed. One solution of the problem appeared to lie in compounding; and he was now at work on this. Many attempts had been made to compound the gas-engine by Dr. Otto, Messrs. Crossley, Mr. Butler, Messrs. Dick, Kerr, and Co. and others; and he (the author) had also, at various times, built experimental compound engines. No success, however, had yet been attained. There was no difficulty in getting some work from the low-pressure cylinder; but the additional work obtained was always too small in amount to justify the expense of the separate cylinder. The lack of success was mainly due to ignorance of the rates of cooling of the working fluid at different temperatures and pressures; and as experiments made with closed vessels did not give much information on the necessary points, he made experiments of this nature on the engine itself in its working condition, instead of on closed vessels. At the beginning of 1905 he devised a new method, and performed a considerable number of experiments on a 50 H.P. gas-engine, by means of which he obtained a cooling curve in the actual engine cylinder and much other information of a useful nature, both from the scientific and the practical points of view.

Proceeding to give particulars of the experiments referred to, Mr. Clerk said the action of the engine was modified by so altering the valve arrangements that at any desired moment both inlet charge valve and exhaust valve could be held closed; and with this device he was enabled to get diagrams from which a cooling curve could be calculated. From this curve the apparent specific heat of the charge could be obtained by calculation. The mean apparent specific heat between 0° C. and 1000° C. was 15 per cent. greater than it was at 100°; and between 0° and 1500° it was 20 per cent. greater. These apparent specific heat numbers enabled a curve of heat-loss to the sides of the cylinder to be obtained either for complete double strokes or for partial double strokes at the inner end of the stroke. Where the engine was running cold, the mean temperature for the complete strokes of the walls was shown to be about 65°, notwithstanding that the jacket water was 13°. For the three-tenths stroke, running cold, wall temperature 165°. With the engine running hot, the whole stroke showed a mean temperature of the walls of 190°; for the inner three-tenths 400°. These differences were accentuated with greater metal thickness almost in proportion to the thickness. These numbers threw an important light upon the problem of the large gas-engine, and enabled him with some confidence to experiment upon the variations of indicator diagram and the transfer of hot gases from cylinder to cylinder required for successful compounding. In modifications of the conditions of the working fluid, combined with mechanical modifications of the engine using it, Mr. Clerk said he hoped to find in the near future some more satisfactory solution of the problem of the large gas-engine than at present exists. It appeared to him to be one more of working fluid than of pure mechanism. Progress in the direction indicated had been somewhat slow; but it had been steady. There was no occasion for discouragement. It was eminently unwise and unsafe to attempt to solve in too short a time the numerous problems involved. Gas-engine builders must be content with the slow growth of experience. Having alluded to the increasing interest shown in the application of large gas-engines to marine propulsion, Mr. Clerk called attention to the great success which has attended the use of the suction gas-producer, by which the power of gas-engines has been materially increased. Tests at the Royal Agricultural Society's show last year had, he said, proved that even small producer-driven engines only require 1 lb. of fuel per B.H.P. per hour, including lighting-up and stand-by losses of the producer at night. Other experiments (some by himself) proved clearly that with a good suction producer one could obtain 85 per cent. of the whole heat of the fuel in the form of inflammable gas ready for delivery to the engine. Many tests had shown that the running consumption of many of these engines at full loads does not exceed $\frac{3}{4}$ lb. of anthracite per brake-horse-power per hour. When referring to the petrol-engine, Mr. Clerk said this year the Royal Automobile Club had made a valuable set of experiments upon the exhaust gases given out by these engines under different conditions of running; and they clearly proved that, so far as visible smoke was concerned, many engines now on the road attained absolute perfection.

In conclusion, Mr. Clerk said that, so far as he understood the question, though large increases in thermal efficiency were still probable, efficiencies were quite high enough at present for all practical purposes; and the main efforts of engineers and scientific men interested in the internal combustion motor should be directed to the solution of the large gas-engine problem in such a way as to reduce the weight and increase the power of the unit; to improve the bituminous fuel producer; to apply the improved engine and producer to marine purposes, and overcome the various difficulties there presented; and in petrol-engines to design carburettors capable of proportioning the charge more accurately than at present under all conditions of running—whether with light or with heavy loads.

IMPROVED INCANDESCENT ELECTRIC LAMPS.

Mr. Leon Gaster gave a short description of the latest developments in the manufacture of incandescent electric lamps, and exhibited a number of new types shown for the first time in England. Owing to the high efficiency of these lamps, Mr. Gaster predicted that the expense for electric lighting will be greatly reduced in the near future, and that better illumination will be obtained. Some of the lamps shown used less than one-third of the energy required by the ordinary carbon incandescent lamps. He stated that the progress made this year had been remarkable. Many manufacturers on the Continent were ready to supply large quantities of these new metal filament lamps, and in England some firms were extending their works with the view of making the lamps here. Mr. Gaster pointed out the desirability for lamp makers to supply lamps combined with suitable shades and reflectors in one unit, so as to assist consumers in obtaining any desired effect of illumination. Particular attention was drawn to the necessity for manufacturers and large consumers of light to adopt proper methods of illumination; the advantages to be derived being manifold. First, the sight of the people would be improved and prolonged; secondly, the output would be quite appreciably increased; and thirdly—and this was very important—the quality of the work done under proper illumination would be of the same standard as when done in the daytime. The economies derived by not using proper methods of lighting were false ones when the fact was borne in mind that the expense of providing and keeping up proper illumination was in most cases only a small fraction compared with the value and the nature of the work turned out; and the author expressed the opinion that this question of defining the proper amount of light necessary for different purposes would form the work of the illuminating engineer as a new specialist.

REINFORCED CONCRETE CONSTRUCTION.

A paper on "Ferro-Concrete, with Examples of Construction," was read by Mr. J. S. E. de Vesian, M.Inst.C.E. The author referred briefly to the various kinds of materials that have been used for constructing buildings from early days, and showed that ferro-concrete is the most rational method, as in the Hennebique

system the disposition of concrete and steel allows of the maximum inherent strength of the two materials being made the utmost use of—that is to say, that the steel takes up all the strains due to tension, while the concrete bears those due to compression. In this manner 1 square inch of steel (say in the tension area of a beam) will interest 30 square inches of concrete on the compression side; and when one thinks of the different cost of concrete and steel, the economy is at once apparent. Not only is this method economical, but it is stated to be also extremely durable and fireproof. The importance of careful selection, of mixing, and treatment of the concrete was shown; and the specifications for this, as well as for the steel, were set forth. The author insisted on the test of reinforced concrete buildings, shortly after construction, with a load of 50 per cent. in excess of the calculated load. The behaviour of Hennebique ferro-concrete under stresses shows that this is really a new material, as its behaviour is so different from that of the concrete and steel separately. Perhaps one of the most marvellous uses of ferro-concrete is in the manufacture and use of piles. An important point which is often raised is the protection afforded to the steel by the concrete. The author mentioned this; giving as an instance the head of a pile which had been cut off and left on the foreshore, where it was uncovered and covered by the tide for more than nine years, and in which the steel showed as good as new $\frac{1}{4}$ inch under the skin of the concrete. This pile-head was brought up and broken in the presence of several eminent engineers the year before last. The impossibility of drawing up fixed rules for reinforced concrete constructions generally by corporations and municipalities was referred to. The chief safeguard to be employed is that of stringent tests after the construction is finished. In cases where much vibration is feared, from running machinery or other causes, ferro-concrete is said to be admirably adapted to minimize the trouble.

Mr. W. Noble Twelvetrees followed with a paper on "Some New Uses for Reinforced Concrete," in which he considered some types of construction that have not yet been applied in this country, others that have been adopted only recently, and others again that are not new in themselves, but are very suitable for employment in novel directions. In the first category may be placed such constructions as railway sleepers, standards for overhead electric cables in power transmission and electricity distribution systems, and poles for telegraph and telephone wires. The paper contained particulars relative to the design, construction, and application of such accessories as these, which are now coming into general use on the Continent and in America. In the second category was considered the employment of reinforced concrete in dock engineering, coast defence and harbour works, and long-span bridges for main-line railway traffic and crossing important rivers, as exemplified by typical structures in this and other countries. In the third category the author indicated the special advantages to be obtained by the adoption of reinforced concrete as a material for the construction of railway station roofs, locomotive depôts, and bridges over railway lines. To illustrate its adaptability to these new uses, he gave brief particulars of roofs that are akin to those generally built in steel for covering railway stations, of a locomotive depôt erected on the Jura-Simplon line, and of highway and foot bridges over railway lines. Fiually, he alluded to the method successfully adopted on the Continent for preserving steel bridges by encasing them in concrete—a course that is commended to the attention of railway compauies and highway authorities in places where the corrosive effect of locomotive fumes is a constant source of trouble and expense.

THE PRESENT ASPECT OF CHEMISTRY.

At the close of the extracts from the address of Professor Smithells to the Chemical Section of the British Association given in the "JOURNAL" last week, it was mentioned that the concluding portiou of the address consisted of some observations on the progress of chemical science and the training of chemists. On these subjects he made the following remarks.

One of the penalties of devotion to a progressive science is the constant feeling of being left behind, and the knowledge that, while we are attending to our personal task, things are happening, near or far, that may, for all we know, be affecting the simplest facts and the most elementary principles on which we have been accustomed to rely. This is a feeling that may well prevail at the present day. At the same time, I do not think there is any occasion for panic; and I cannot help regretting the somewhat sensational language that has been used, even within our own circles, in regard to recent discoveries. The revelations attendant upon the investigation of radio-activity do indeed mark a distinct epoch in the history of chemical discovery; but that they entail anything like an unsettlement of our scientific articles of faith is not to be admitted for a moment. They make us realize in perhaps a not unprofitable way that scientific knowledge and scientific theories are necessarily proximate, never ultimate, and that ideas which may have been entertained for a long time without any modification, and so have begun to seem perpetual, are, after all, only provisional.

The perplexities of chemists at the present day do not come, I think, from the novelty of the ideas that are being presented to them, but from the great rapidity with which the whole science is growing, from the invasion of chemistry by mathematics, and, in particular, from the sudden appearance of the subject of radio-activity with its new methods, new instruments, and especially with its accompaniment of speculative philosophy. There is an uneasy feeling that developments of great importance to the chemist are being made by experiments on quantities of matter of almost inconceivable minuteness. Spectrum analysis, of course, took chemistry beyond the limits of the balance; but the new materials which it disclosed could at least be accumulated in palpable quantity. With radio-activity we seem, in relation to the ponderable, almost to be creating a chemistry of phantoms; and this reduction in the amount of experimental materials, associated as it is with an exuberance of mathematical speculation of the most bewildering kind concerning the nature, or perhaps I should say the want of nature, of matter, is calculated to perturb a stolid and earthy philosopher whose business has been hitherto confined to comparatively gross quantities of materials and to a restricted number of crude mechanical ideas.

I should, however, gravely abuse the position in which I am allowed to speak for the moment as a representative of chemists if I failed to express profound admiration for the masterly work which has been accomplished by the pioneers of the science of radio-activity. All that I wish to say beyond that is in explanation of a certain awe or trepidation which chemists of the older school may feel in the presence of such bold explorers; and I am the more tempted to say something on the subject, because in recent times, before the advent of radium, a good deal has happened which has given chemists occasiou to ask themselves whether chemistry was not beginning, as it were, to drift away from them.

The most conspicuous development of the science during the past twenty years has been, of course, on the physical side; and abundant have been its fruits. But it has seemed to demand from chemists habits and endowments which they did not normally possess, and which they could not easily acquire. I was much struck by a remark made to me a few years ago by a distinguished chemist, who is, I think, the most perfect manipulator I have ever seen at work, to the effect that he felt himself submerged and perishing in the great tide of physical chemistry which was rolling up into our laboratories. Now, it is precisely such men that must be preserved to chemistry. Though chemistry and physics meet and blend, there is, I believe, an essential difference between the genius of the chemist and the genius of the physicist; and I venture to thiuk that some insistence on the primary functions of a chemist is not untimely. The chemist's first qualification is that he shall be master of a peculiar craft; his greatest merit, that he is a consummate workman; his distinctive power, a nicety of discrimination in all questions affecting the composition and quantity of materials. He is not given to elaborate theories, and is usually averse to speculation; nor has he generally an aptitude for mathematics. Such the normal chemist is, or was, and such I hope he always may be.

There seems to be a solicitude in some quarters to make a chemist something more than a chemist—a solicitude which, if gratified, will, I believe, make him something less than one. We are told, for example, that a chemist should be a mathematician. I do not admit it for a moment. Some mathematics he must of necessity have—that has always been admitted. But in proportion as chemistry develops on the mathematical side does it become important, not that our chemists should be trained in mathematics, but that they should be more than ever carefully trained in the art of exact experiment; that their methods of work, their powers of observation, and, if possible, their experimental conscience, if I may use the expression, should acquire a finer edge. There is never more cause for anxiety than when we see a mathematical theory awaiting the delivery of the confirmatory facts; there is nothing more important for chemistry than the continual recruiting of that Old Guard which will be ever ready to stand to arms on the appearance of an eager theorist.

Chemistry is becoming bewildering in its extent; and it would be a great misfortune if this led to the notion that every chemist must try to enlarge his ambit to its confines, and to fit himself for every variety of work. Those of us who have responsibilities as teachers cannot, I think, be too careful, lest in the attempt to secure breadth we may encourage shallowness, and fail to give our students that peculiar and time-honoured discipline in exactitude of work in chemistry proper which has characterized the chemists of the past, and which is infinitely more important than superficial dealings with a great variety of processes and appliances. I confess that I have frequent misgivings as to whether our modern courses of instruction may not tend to turn out chemists more learned in the science and less perfect in the art than was the case under the ancient *régime*.

Another perturbation within the chemical camp in recent times has come from the region of philosophy. Even before the days of radium we have been accused of clinging too fondly to our atomic theory, and of stating our knowledge too exclusively in terms of that theory. We are said to have drifted into a dogmatism as real as any we ourselves have had to attack, and to shut our eyes to the light which will enable us to orient ourselves truly in the wide realm of thought. The answer that most of us would give would be, that we value our hypotheses according to their productiveness in new knowledge; and that it is, on the whole, perhaps better to over-exalt an hypothesis that is fertile than, from high considerations of philosophy, to allow our ideas

to become so fluid that they can afford no rigid framework for thought. I think that the attempts to view chemical phenomena apart from atomic hypothesis, interesting as they undoubtedly are, have not made us feel that this hypothesis has either misled us in any matter of fact or obscured any pathway that we might have followed with greater profit. The value of the thermodynamical treatment of chemical problems is attested by its fruitfulness in promoting fresh discoveries; and here we may welcome a valuable adjunct to the atomic hypothesis. But I do not think we are called upon to acclaim a new method of treating old questions, unless it promises some more tangible result than an alleged improvement of our intellectual morals.

Few, I think, will deny that the atomic theory stands to-day as an indispensable instrument for productive chemical work; it has neither had its day nor ceased to be. Physicists have never been quite satisfied with the hard, indivisible ball of specific substance and definite mass which has served chemistry so well. They have given it bells, have made a vortex ring of it, and have indeed done much that few chemists can understand to make it meet the exacting requirements of their science. But to us it has always been the same; what we have done to it has been external—we have given it, vaguely perhaps, a charge of electricity, a store of energy. We have attached the hooks or rods of valency; but we have not meddled with its interior. We are now called upon by chemical considerations of change of composition, as well as by other considerations more recondite, to subdivide our atom, to credit it with an unsuspected store of energy, to consider it a congeries of unsubstantial electrons. We should wish, of course, to know that the evidence is good enough; but otherwise there can be no possible objection from our side. It will undo nothing that has been done; and we may have good hopes that it will lead to the doing of many new things in chemistry. The newer theories are in consonance with the old in one most vital point—they afford those mental pictures of phenomena which most of us find indispensable for fruitful work. They do not belong to what Professor Schuster has characterized as "the evasive school of philosophy."

A NEW CONTINUOUS WATER-SOFTENER.

By Harold Baron, B.Sc.

It is a well-known fact that, in most operations in which water is employed, it is not possible to make use of it in the condition in which it naturally exists. Various substances in solution, which form scale in boilers and have a destroying effect upon soap, have first to be removed. In general, the purification takes place in two stages. First, the scale-forming constituents of the water are precipitated by means of chemical reagents, and the muddy liquor so obtained is mechanically clarified by means of special apparatus. Finally, the water is passed through some form of filter, and is then in a fit state to be pumped into the boilers, or used in many of the applications where pure water is a necessity.

The chemical treatment of water to be softened is sufficiently well-known to need no detailed description here. It usually takes the form of precise additions of lime and soda, depending upon the dissolved constituents of the water as determined by chemical analysis. The bicarbonates of lime and magnesia, which form the "temporary hardness," and the sulphates and chlorides, which produce the "permanent" hardness, are precipitated as carbonates. The water is thus rendered turbid, and must be clarified and filtered before it can be used for industrial purposes. The clarification and filtration of the water are at least as important as the chemical treatment, and form an essential feature of all the water purification apparatus employed at the present day. The various forms of water-softeners on the market differ mainly in the construction of the settling tank; and it is well-known that in many softeners this part of the apparatus, in which the settling out of the mud is effected, is of complicated construction.

The insoluble matter precipitated in the chemical treatment can be divided, broadly, into three classes—matter which sinks after a comparatively short time, matter which remains in suspension, and matter which floats. The first of these can be removed by allowing it to settle out; while the two latter must be removed by filtration. The aim of the water-softening chemist is to keep the proportion of suspended matter as low as possible, in order to avoid as far as he can periodical spoiling of the filter. The clarification of water on a large scale is effected by allowing the mud to settle out in basins or tanks of suitable character. The usual forms of construction may be divided into three classes: (1) Settling in still water, (2) settling in a slowly ascending stream of water, and (3) settling in a descending and ascending stream of water. The method usually preferred is the third of these, in which the water moves first downwards and then upwards. The advantages of this plan consist in economy of space and increased capacity. Most of the water-softeners in general employment to-day make use of this principle.

In considering the construction of the settling-tanks in which the mud formed by the chemical treatment is to be separated, a number of important points must be observed. The distance through which the particles of mud in settling have to pass should be as short as possible; any sudden alteration in the direction of the stream of water flowing through the apparatus should be avoided; the speed of the water current in the vicinity of the deposited mud must obviously be as small as possible (otherwise the sediment is liable to be stirred up again); and, further, the path through which the current of water is led should be as long as practicable, so that as much as possible of the suspended matter can settle out before the current of water reaches the filter. A number of practical requirements should be added to the theoretical considerations enumerated above. The softener should not be too complicated; otherwise the cost of construction will place it beyond the reach of the majority of steam users and those to whom softened water is a desirable, but not a necessary, raw material. Then, too, the space taken up by the apparatus must not be too great, since the available space in many existing boiler-houses leaves only sufficient room for a water-softener of modest dimensions. Moreover, the apparatus should work as far as possible automatically, so that its attendance may not form too large an item in the working expenses.

The "Rottmann" continuous water-softener, which has lately been introduced by Messrs. J. A. Miller and Co., of Berlin, would appear to approach somewhat closely the theoretical and practical requirements necessitated in modern water-softening practice. Figs. 1 and 2 show the apparatus in vertical section. The crude water enters in the direction of the arrow at *a*, and passes out into the distributor F. Part of the water then flows into the heating and mixing tank B; while a further portion passes by the special pipe into the apparatus C, where the lime water is automatically produced. The tanks A and E serve for the preparation and introduction of the soda solution. In the mixing-tank B, the water is heated up with fresh or spent steam, and mixed with the chemicals, lime and soda, introduced under automatic control from the tanks E and C. Treated in this way, and now containing much insoluble matter, the water pours over into the settling-tank D, in which the process of mechanical clarification takes place. The current of water flows slowly down the narrow section of the apparatus, and the suspended matter gradually settles out and locates in the basin K. From time to time the mud which has located here may be washed out through the outlet *l*. The settling-tank is so constructed that the turning

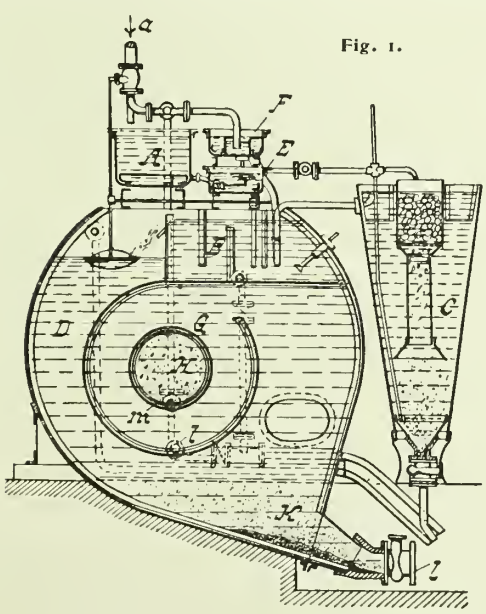


Fig. 1.

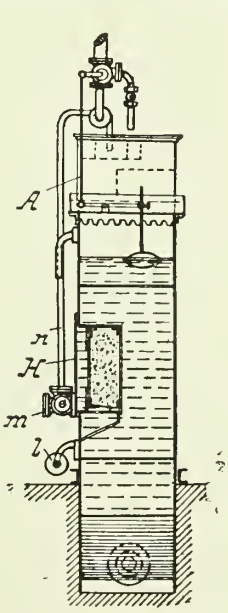
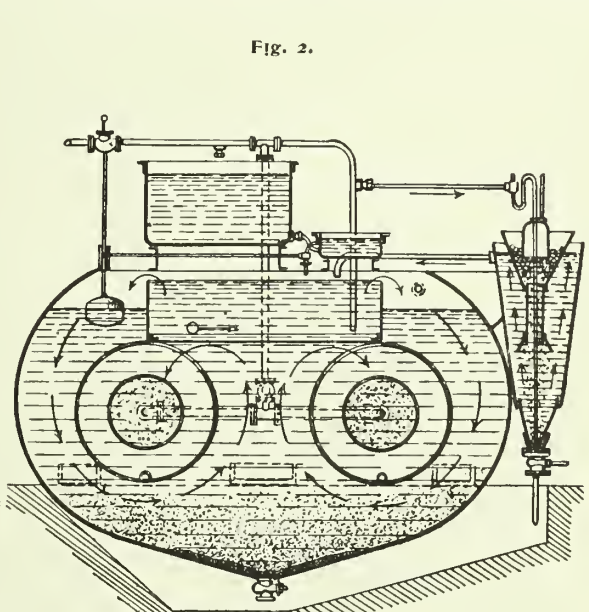


Fig. 2.



The "Rottmann" Continuous Water Softener.

of the current from the downward to the upward direction only takes place very gradually; so that the water remains a long time above the mud bay, and every facility is allowed for the particles of insoluble matter to settle out. Since the section of the apparatus is much narrower in the part where the current of water flows downward, the velocity of the current is here greater than in the portion of the apparatus where the current flows upwards. The velocity of the water in the downward direction gradually increases up to a certain point, and then in the upward direction gradually increases. The object of this is to accelerate the precipitating matter in the downward movement towards the basin K, while in the upward movement the velocity of the current is so small that the finer suspended particles, which take a longer time to settle out, are given every opportunity to fall out of the current.

From the outer settling-tank, the water now passes into the filter-chamber G. Here there is another mud outlet *l*, so that any matter which may locate at the bottom can be removed. Finally the water passes through the filter H, and can now be taken away for consumption at *m* in a perfectly clarified condition. The filter is built into the apparatus in such a way that the surface on which the current of water impinges is vertically situated. On this account, there is little tendency for the mud to settle on the surface. The filter, which may be conveniently made from sand and gravel in a filter-box, is arranged so that it can be easily taken out of the apparatus from the side. This, however, need only occur when it is necessary to provide the filter-box with a new filling. In most cases, it can be cleaned out by reversing the direction of the flow of water through the softener by means of a three-way cock, which is specially provided for this purpose in the pipe *n*. For very large softeners, special apparatus is provided, by means of which the sand in the filter-box may be stirred up, and in this way cleaned. As filter material, gravel, sand, coke, and wood pulp may be used. The filter surface should be of such an area that the speed of the water passing through does not exceed 15 to 30 feet per hour. A convenient width of the filter, which, of course, depends upon the character of the water dealt with, is 8 to 12 inches.

In fig. 2, a modification of the apparatus is shown, which is especially designed for dealing with large quantities of water up to 10,000 gallons per hour. The principle of the apparatus is identical with that of the one previously described, and differs only in being provided with two filter-chambers. The water, after being treated with lime and soda, and heated with steam in the central reservoir, falls over at both sides into the concentrical settling-tank. The currents of water increase in speed as they pass downwards at both sides, and then meet one another in the middle of the apparatus above the mud-collecting basin. Above the mud-collecting place, as will be readily observed from the illustration, the current of water is slow, on account of the increased width of the channel at this point. The water then divides and passes into the two filter-chambers, from which it is taken away in a purified condition.

A water-softener of the type shown in fig. 1 has been for some months at work in the boiler-house of the Luxemburg Prison authorities. Its operation has been satisfactory in every respect, as a water of 16 degrees of hardness has been reduced to 3 degrees, and this state of efficiency maintained. The attendance required by the apparatus is very slight, since the chemicals and water supply are automatically controlled, and the whole operation of softening is a continuous one. There can be no doubt that the "Rottmann" continuous water-softener will be much heard of in the early future.

Prize Winners in the Examinations in "Gas Manufacture."

We have received from Sir Philip Magnus, M.P., the Superintendent of the Department of Technology of the City and Guilds of London Institute, the names of the prize winners at the last examinations in "Gas Manufacture." They are as follows: Honours grade, first prize (£2 and a silver medal), Archibald Edgar Williams; second prize (£2 and a bronze medal), Clarence Harris. Ordinary grade, first prize (£1 and a silver medal), Frank Eliot Williams; second prize (£1 and a bronze medal), James Robert Bradshaw; third prize (a bronze medal), Thomas Walter Saville and Arthur Robert Wyatt (equal). The money prizes, as our readers are aware, are given by the Salters' Company. The winners of the first prizes are brothers—one being in the service of the Commercial Gas Company, and the other in that of the Imperial Continental Gas Association. They were students at the Regent Street Polytechnic, under Mr. Walter Grafton, where, as will be seen by the following list, they both obtained first prizes in the examinations conducted at that institution in April. Moreover, Mr. A. E. Williams was among last year's prize winners—being first in the Ordinary grade at the City and Guilds, and second in the same grade at the Polytechnic examinations. The following is the Polytechnic list: Honours grade, first prize (Polytechnic silver medal and a certificate), Archibald E. Williams; second prize (10s. and a certificate), Joseph Fisher; third prize (5s. and a certificate), P. Gwynn Jenkins. Ordinary grade, first prize (Polytechnic bronze medal and a certificate), Frank Eliot Williams; second prize (10s. and a certificate), W. F. Brown; third prize (5s. and a certificate), George Winslow. Certificates in the Honours grade were obtained by R. Lennox Fenner, Francis Higgins, and A. Harcourt Meade; and in the Ordinary grade by W. Beard and E. J. Luff.

REGISTER OF PATENTS.

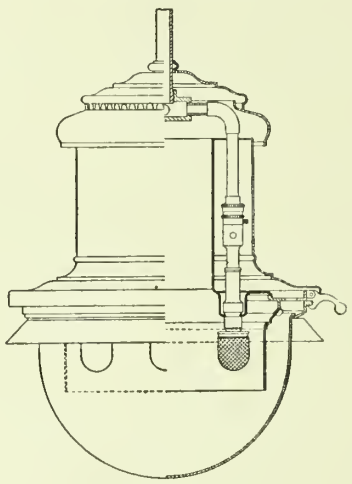
Incandescent Gas-Lamps.

DEUTSCHE GASGLÜHLICHT AKTIENGESELLSCHAFT (AUERGESELLSCHAFT) of Berlin.

No. 12,623; May 30, 1906. Date claimed under International Convention, June 7, 1905.

In incandescent gas-lamps in which the mixing-tube with the mixing-devices are arranged in the passages through which the combustion gases pass away, the patentees point out that the known defect exists that, in addition to a prejudicial heating of the whole of the lamp casing, the mixture of gas and air is excessively heated in the mixing-tube; so that, in consequence of its increased buoyancy or tendency to ascend, there is produced "an increased resistance to the movement of the mixture of gas and air." Owing to the weakening of the action of the jet of gas thereby entailed, the suction of air is diminished likewise; so that a bunsen flame which is partially luminous is produced, the "unpleasant noise" is increased, and the incandescent body becomes blackened. This defect arises principally when the gas pressure is comparatively low, or if it falls while the lamp is burning. For the purpose of obviating these defects, provision has at times been made for arranging the mixing-tube and the mixing-device in a special chamber separated from the waste gases; the air being drawn into the chamber while the combustion gases themselves pass out of the lamp through a chimney.

The present invention relates to an inverted incandescent gas-lamp of this kind; and the invention mainly relates to the particular formation of a closed air container constructed in such a manner as to surround the chimney or chimneys through which the combustion gases are conducted wholly or partially through the incandescent bodies, and which at the same time receives the mixing-device and the mixing-passage. The arrangement may also be such that only the burner-heads and the incandescing bodies extend through the bottom of the air-reservoir into the combustion chamber of the lamp. By means of the combination in accordance with this invention, the following advantages are (it is said) obtained among others.



A German Form of Inverted Gas-Lamp.

The mixing-tubes, with the mixing-device, which lie outside and around the discharge passage or chimney, are (as shown) readily accessible for the purpose of cleaning and placing in position, and are protected from the direct action of the combustion gases and from injury by the same. Effective transmission of heat to the mixing air in the air-reservoir (which does not, however, exceed the permissible amount) is produced, so that by the preliminary heating of the air for the mixture an increased luminous effect is obtained; while, on the other hand, the lamp will not fail owing to low or falling pressure in the gas-supply pipe. The outer parts of the lamp are not excessively heated; and, owing to the diminished transmission of heat to the outer casing of the lamp, the result is attained that the parts are less liable to crack. The supply of air to the mixing air-reservoir may be regulated and adjusted by properly dimensioning the admission openings. Further, the chimney may be given as large a cross section as desired.

Another essential point is that the flue or chimney for the combustion gases may be of such a size relatively to the openings of the air-reservoir conducting the air into the combustion chamber, that a reduced pressure exists in the combustion chamber. In this way, a suction-effect is exerted on the interior of the mixing-tube in the air-reservoir; the air suction of the bunsen burner is largely increased; and its efficient action is not so dependent as before upon the suction-effect of the jet of gas—that is to say, upon the gas pressure. The desired end may advantageously be attained by arranging the upper opening of the discharge passage or chimney higher than the air admission openings of the combustion chamber.

It is advisable that the air-reservoir receiving the mixing-tube should communicate with the outer air only at its lower part. The result of this is that when the air-reservoir is carried sufficiently high, the air (owing to the heating) ascends by virtue of its natural buoyancy, and becomes dammed up in the air-reservoir—producing a certain excess pressure. This excess pressure propagates itself through the air-openings of the mixing-tube, and thereby assists the action of the bunsen burner. Further, the advantage is obtained that, owing to the diminution of the specific weight of the air, the injector action of the bunsen burner is rendered increasingly favourable, as the specific weight of the air approaches that of the gas.

Inverted Burners for Incandescent Lighting.

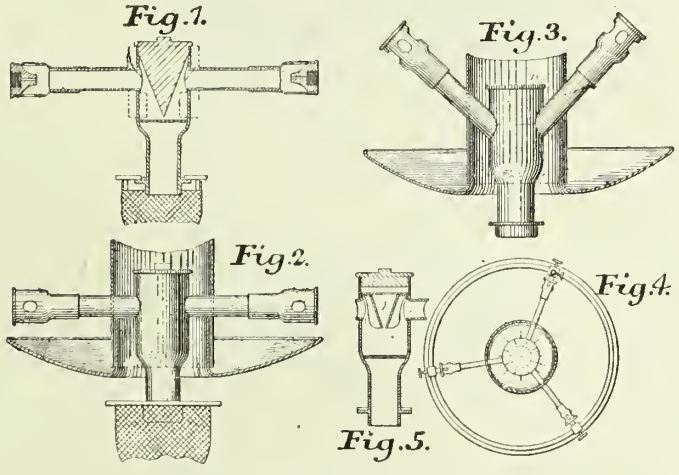
FRANCIS, A. S., of Farringdon Road, E.C.

No. 15,337; July 5, 1906.

This invention comprises improvements in, and connected with, inverted atmospheric gas-burners for incandescent lighting, concerning which the patentee says: As at present constructed, they have not been satisfactory or economical when they have been required to give off a light of more than (say) 100-candle power, or to consume more than (say) 6 or 7 cubic feet of gas per hour; and "attempts to produce burners to consume larger quantities of gas with a corresponding increase of light emission have not so far been successful." The chief reasons of non-success in attempts to produce a large inverted burner have been: The difficulty of arranging a gas-injector to draw in sufficient air to the bunsen tube for perfect combustion and to maintain a sufficient velocity of the mixture through the tube; the difficulty of obtaining a perfect admixture of the air and gas; and the reduction in velocity of the mixture owing to its expansion, due to heating by the products of combustion. As a result, insufficient air was drawn in, the velocity of the mixture was low, the temperature of the flame was reduced, and lighting-back was rendered possible. Thus there was an unsteady and poor light, soot was deposited on the burner and mantle, and an unpleasant smell ensued. Clusters of lights have sometimes been used in place of one large light; but in a cluster, opposed portions of the mantles absorb the light from one another, and are therefore to a certain extent less efficient. Such a cluster was proposed in patent No. 8734 of 1905; and the present invention may be said to be a development of the arrangement there described. In one arrangement heretofore proposed, the inverted burner was made Y shape; the upper inclined members (of which there were two or more) being short compared with the length of the stem of the Y, and the gas being introduced by jets situated at some distance from the openings of such inclined members and delivering gas under pressure.

The principal object of the present invention is "to construct a burner which will efficiently heat an inverted mantle when burning large quantities of gas—say, from 6 cubic feet per hour and upwards." The invention also provides for preventing the air supply to such a burner from being vitiated by the products of combustion.

The simplest form of burner proposed comprises two or more bunsen tubes of any convenient construction having their delivery ends or points connected with a common mixing-chamber from which depends the burner proper. The burner may be vertical, and the plurality of bunsen tubes for supplying them with mixture may radiate from them—say horizontally and symmetrically, or as found convenient. The burner proper is preferably of smaller diameter than the common mixing-chamber, but of greater capacity than all the bunsen tubes. The air and gas inlets of each bunsen tube may be fitted with suitable regulating devices. The common mixing-chamber may be fitted interiorly with deflecting devices (one opposite each bunsen tube) for the purpose of diverting the flow from the bunsen tubes downwards into the vertical chamber and burner without appreciable loss of velocity. A single deflector common to all of the bunsen tubes, such as an inverted cone or frustrum thereof, may be used if preferred. Beneath the cone, and conveniently near the bottom of the chamber, a wire gauze or other screen may be situated to cause further admixture of the air and gas, as well as to prevent lighting-back of the flame. Care must be taken, however, that the mixing-chamber and burner shall be of sufficient diameter to take the heated mixture which has expanded, and that the screen shall be of such a character, and so situated, as not to appreciably obstruct the flow of the mixture.



Francis's High-Power Inverted Burner.

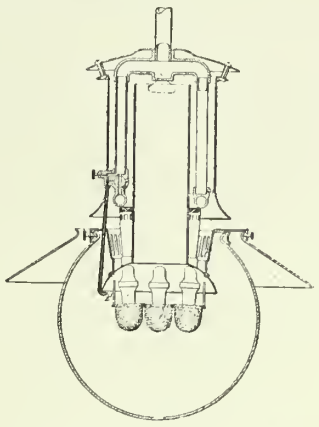
Fig. 1 is a vertical section through one form of burner constructed according to this invention. Fig. 2 is a sectional elevation showing a burner fitted with a reflector and chimney. Fig. 3 is a part vertical section and part elevation of a modification. Fig. 4 is a plan of a burner having a ring supply pipe connected to it. Fig. 5 is a central vertical section of a modified form of burner having the bunsen tubes broken away.

Gas-Lamps.

HUMPHREY, A. H., of New York.

No. 17,836; Aug. 8, 1906. Date claimed under International Convention, Nov. 16, 1905.

This invention relates to inverted gas-lamps of the kind in which each separate burner is fed by a burner-tube; and the burner-tubes are connected to a ring pipe arranged outside the chimney, to which gas passes by means of branch pipes from the supply pipe. Hitherto bent burner-tubes have been arranged so as to pass from the gas-ring pipe arranged outside the chimney, through the flared chimney or flue, and then down the chimney to the separate burners. By the present invention, however, each separate burner is fed by a burner-tube which passes downwards outside the chimney and through the outwardly projecting flange on the chimney to the burner, "so as to feed the gas to the burners at a much lower temperature than would be the case if the burner-tubes passed down the chimney, and so prevent the liability of back lighting." The general construction of the lamp is improved by supporting the globe and shade on the flange of the chimney (as shown) instead of on the outer casing.



Humphrey's Inverted Gas-Lamp.

In operation, the heated air and gases from the burners pass up through the chimney and out under the shield above it. The burner and gas delivery pipes are protected from these heated gases so that they do not become unduly heated, and cause back-lighting.

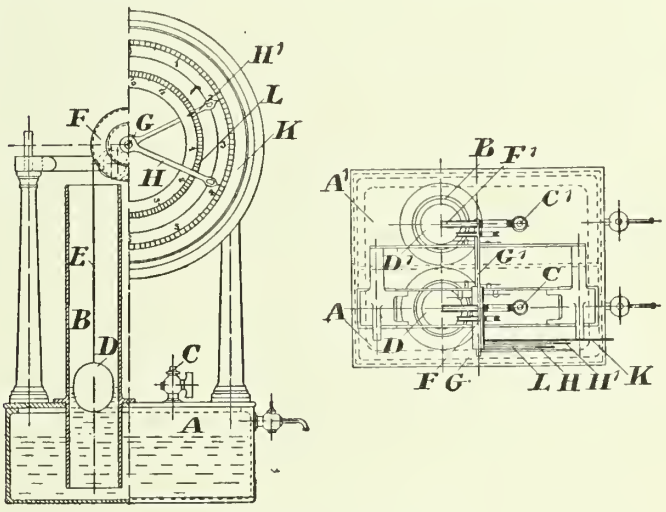
The burners are fully protected from draught, so that the flame is directed to heat the entire mantle; and at the same time the desired supply of air is insured, owing to the draught which is set up through the chimney. The burners, being grouped about the chimney, are in such a position that the fresh air is drawn up through the mantles—thereby "insuring perfect combustion of the gases."

Indicating the Pressure of Gas, Air, &c.

THOMAS, W., of Vancouver, B.C., and MILNE, J., of Edinburgh.

No. 21,300; Sept. 26, 1906.

The apparatus claimed by the patentees is of the kind known as a King's pressure gauge—consisting of an enclosed vessel containing within it a chamber extending down to near the bottom of the vessel communicating with the first vessel at the bottom, and open to the atmosphere at the top.



Thomas and Milne's Pressure Indicator.

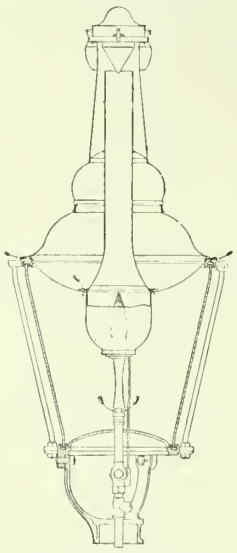
As shown, the vessel A is partly filled with water and the pressure of the gas is brought to it at C, so that it can press upon the surface of the water and force it up the chamber B (which is open to the atmosphere) to a greater or less extent according to the pressure of gas. A float D is provided in the chamber B which rises and falls with the water; and to it is attached a cord E, which passes over a pulley F, upon the axle G of which is fixed a pointer H to indicate the pressure. The apparatus consists of two such gauges, set together or made up in one case. The one gauge is connected at C to the gas as it enters the apparatus; the other gauge is connected at C^1 to the gas as it leaves—thus the two gauges show the inlet and outlet pressures respectively. One gauge is placed immediately behind the other, so that the axes of the pointers are identical; the axle of the rear gauge G^1 being solid, while that of the front gauge G is tubular. Thus both pointers H and H^1 can be fixed in front of the dial K, and indicate both pressures on it. To obviate the necessity of deducting the pressure of the inlet from that of the outlet when it is desired to obtain the pressure taken up by the apparatus, there is fastened to the pointer H^1 a ring or disc L divided and arranged to revolve with the pointer H^1, to which it is fixed. The other pointer H then indicates the difference of pressure between the inlet and outlet.

Street and Other Gas-Lamps.

WALKER, A. B., and DONALDSON, J. H., of Wallsend.

No. 22,131; Oct. 6, 1906.

This invention has special reference to intensified incandescent gas-lamps, and has for its object "to generally improve the construction and arrangement of such lamps so as to render them more efficient in use."



Walker and Donaldson's Street-Lamp.

The dome or bonnet of the lantern is made (as shown) with a detachable chimney, and there is a loose or separate intensifying tube fitted over and resting upon the globe—being provided with a packing ring, as usual, to make an air-tight joint. To obtain access to the burner or the interior of the lantern, the chimney and the loose intensifying tube are removed, when the dome or bonnet can be opened and turned back on its hinge as usual. When it is only desired to fit a new mantle to the burner, sufficient access can be obtained by merely removing the detachable chimney and the loose intensifying tube. It is only necessary to open the dome or bonnet when access is required to the whole interior of the lamp, as for cleaning and similar purposes. If desired, the detachable chimney may be provided with a guide or guides for maintaining the loose intensifying tube in correct position. By these means it is possible to dispense with the adjustable gallery and the hinged door at the bottom of the lantern; and as the globe is not clamped between the gallery and the intensifying tube but only supports the latter (which is not of great weight), there is less likelihood of the globe fracturing under heat and expansion.

Instead of fixing the reflector to the dome and admitting the air for combustion, which enters between the dome or bonnet and the top ring of the lantern frame below the reflector (as customary), a loose reflector is made to rest on a ledge on the top ring of the frame, so that the air enters the dome above the reflector and is heated by the intensifying tube. It then passes into the lantern and to the admission holes of the burner.

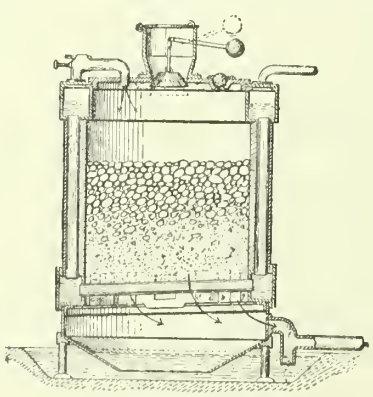
To reduce the shadow cast vertically below the lantern, it is provided with a transparent spherical or dome-shaped base, preferably formed in one piece, with suitable apertures for the passage of the gas supply and bye-pass pipes. In the supply pipe and outside of the lantern is a "blow through" branch or connection, normally closed by a cap or plug, so that the pipe and burner may be cleaned without removing the latter.

Gas-Producers.

ARMSTRONG, C. L., of St. Louis, Missouri, U.S.A.

No. 24,666; Nov. 3, 1906.

This invention relates to down-draught gas-producers in which the producer generates its own steam, which, after being mixed with air, is led to the top of, and through, the fuel in the grate. The object of the invention is to construct a producer in which a mixture of preferably saturated steam and air is forced downward (at stated intervals) through the fuel charge; the downward current being in a measure supplemented by the suction on the bottom of the fuel, resulting from the abstraction of the producer gas by the engine to which it is supplied.



Armstrong's Gas-Producer.

A special feature of the device shown is a pressure in the upper part of the generator produced by the introduction of steam mixed with air in suitable proportion. One effect of this pressure is to produce a downward current or flow of the intermixed steam and air, and thus facilitate the expulsion of gas through and from the lower portion of the generator. A more important effect is to condense the material designed for conversion into gas (especially when of light texture or character, like peat, lignite, coal slack, &c.) and maintain continuity and homogeneity in the bed within which partial combustion and the accompanying gasification take place. A still more important effect is to promote the union of the carbon and oxygen molecules by condensation, and thus increase the formation of carbon monoxide and keep the carbon dioxide down to a minimum. Incidentally, the pressure tends also to raise the temperature of the intermixed air and water vapour, thereby facilitating combustion and reducing the ratio of fuel consumed to that converted into gas. The downward passage of the gas and steam and air mixture through the mass of incandescent carbon further results in a complete elimination from the charge of all tar products; their disappearance resulting from the destructive distillation and incomplete combustion to which they are subjected in their passage—the products of distillation combining with the gases of the solid portions of the charge and conjointly escaping from the bottom of the producer. Another object is to construct a producer which shall serve as a furnace for its own boiler—the latter being provided with a water-tube grate for the direct support of the fuel; while a further object is to produce a gas which will not require a tar extractor or scrubber, and from which all solid particles and impurities are eliminated as it leaves the producer—such impurities being deposited in a water seal, which at the same time receives the ashes.

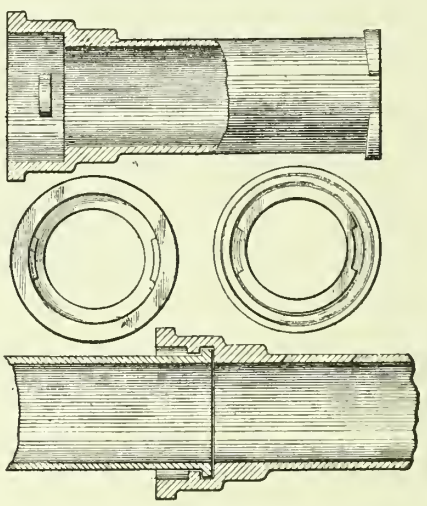
Socket and Spigot Pipes.

KEYWOOD, H. G., of Hoyland Nether, near Barnsley.

No. 25,343; Nov. 10, 1906.

Pipes constructed according to this invention have at the spigot end two or more concentric parts, bands, or bolts in the form of a flange having blanks, recesses, or spaces in them. Within the socket end of each pipe are projections or keys corresponding to the blanks or recesses on the spigot, and in such relative position that, when the spigot is placed with its blanks opposite the keys or projections within the socket of an adjoining pipe and pushed into the socket and then partially turned, the projecting portions or part flanges of the spigot pass behind the projections or keys in the socket, and the bores of the pipes are necessarily continuous and form a true invert by reason of the part bands or belts on the spigot ends of the pipes being in thickness equal to the interior diameter of the socket end of the adjoining pipe. The pipes are thus in correct relative position for being permanently jointed by lead, clay, cement, or other caulking or stopping according to the purpose for which they are to be employed.

In the case of cast-metal pipes, the projections or part flanges of the spigot end and the keys in the socket will preferably be cast thereto and form part of such pipes; but in the case of fire-clay or earthenware pipes, the projections or part flanges and keys may be moulded thereon or separately prepared and affixed thereto before or after firing or burning, and by the usual means of jointing parts of plastic wares, or by bitumen.



Keywood's Socket and Spigot Pipes.

The illustrations show an elevation partly in section of a pipe made according to this invention; an end elevation of the socket end of the pipe; an end elevation of the spigot end; a longitudinal section showing the spigot and socket ends of two pipes in position and ready for being permanently jointed.

APPLICATIONS FOR LETTERS PATENT.

17,267.—POWNALL, T., "Gas-producer." July 29.
17,319.—HALL, E. A., "Three-way cocks." July 29.
17,329.—HALL, E. A., "Air and gas mixing apparatus." July 29.
17,350.—EDGAR, W., "Plug taps." July 29.
17,376.—GOVAN, A. A., "Manufacture of sulphate of ammonia." July 30.
17,386.—SHAW, C. J., and WILLETTS, G., "Convertible arms for gas-fittings." July 30.
17,395.—COLE, R. & F., "Tap." July 30.
17,401.—FOWLER, W., "Gas-economizer." July 30.
17,438.—BOTLEY, C. F., and CUTLER, S., JUN., "Gas-generators." July 30.
17,442.—TURNER, F., "Inverted burners." July 30.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Capital Expenditure of Gas Companies and Local Authorities.

Sir,—It will, I fear, be thought that already too many figures have been cited in this controversy over what is in reality a very plain case. Your attitude with regard to it is the more remarkable because it has been apparent for years that the local authorities are reducing their capital indebtedness per million cubic feet much more rapidly than are the companies. But you want more figures; and, not content with renewing your charges against me of unfairness, attribute to me in addition a want of "alacrity" in, and a desire to "escape" from, complying with your behest. Need I say that had there been any reason to suppose that fresh light would have been thrown on the subject by the comparison you suggest, or that it could lead to a conclusion different from that which is afforded by the returns in their entirety, I should have made it long ago. However, it has now been made, and the particulars are given below. Four or five of the local authority undertakings—amongst them those of Birmingham and Glasgow—have had to be excluded, owing to a difficulty in finding for them suitable partners; and I have been obliged to include one of your prohibited companies—the Commercial—which, by-the-bye, is anything but "unique" as regards size. This inclusion was only to be avoided by a further omission from the other side.

Gas Sold.

	Million Cubic Feet.		Increase.	
	1882.	1905.	Million Cubic Feet.	Per Cent.
143 Companies	15,942	37,738	21,796	136
143 Local Authorities . . .	15,458	35,957	20,499	132

Capital Indebtedness.

	1882.	1905.	Increase. Total.	Per Million Cub. Ft. Sold.
143 Companies .	£11,073,414	£22,443,990*	£11,430,576	£525
143 Local Authorities.	11,188,683	15,524,463	4,335,780	212

* After deduction of amounts added by conversion of stock.

The difference in favour of local authorities is seen to be £313 per million cubic feet; whereas in my previous comparison it was £311.

15, *Victoria Street, S.W., Aug.* 3, 1907. Chas. Hunt.

[It may be claimed that a point has at length been gained, by the pressure applied, in getting Mr. Hunt to expand his figures. But really we do wish that someone would tell us how it is possible to make clear to Mr. Hunt (seeing that we appear to have failed so far, though using the plainest of language) that our quarrel is not with his figures, but with his insufficient explanation to inexpert people as to the causes which tend to widen the difference in the capital expenditure of gas companies per million cubic feet as compared with local authorities. We must insist on this point being kept in the foreground, as that was the gravamen of our reference to the matter in the leading article on the Hull Purchase Bill in the "Journal" for July 9; and we emphasized it in the editorial notes to the letters from Mr. Hunt in the issues for July 16, 23, and 30. Our correspondent, inexplicably, has made no recognition of the point, but again says: "Your attitude with regard to it [not our complaint, but Mr. Hunt's point] is the more remarkable because it has been apparent for years that the local authorities are reducing their capital indebtedness per million cubic feet much more rapidly than are the companies." Can Mr. Hunt point to any statement in the "Journal" on or since July 9 where this has been denied? We think not. He then says that we have attributed to him "a desire to 'escape' from complying with our 'behest'"—that is to say, the suggestion for more figures. That is a deviation from fact; our remark being: "We are not disposed to let him 'escape' the sole point that raised this correspondence—that it is unfair before any body of men inexpert in gas finance to quote the average figures as to capital per million cubic feet of the local authorities and gas companies, without fully explaining certain conditions that tend to the widening of the difference between them." That is a distinct variation from the rendering of our correspondent. The suggestion for a comparison of an equal number of fairly comparable company and local authority undertakings was made because it was believed there would be interest in weeding out from the companies the small and heavily capitalized concerns. But Mr. Hunt cripples investigation and minimizes interest by not giving us the names of the concerns and the details (which he must have got out) composing the totals published in this week's letter. If consideration for our space induced economy on his part, it is a matter for regret, after the invitation given to him on July 23. The matter is one of importance to gas companies; and if the result of this correspondence induces a modification of, or the putting of a different complexion on, such statements as were made in the Presidential Address at Dublin and before the House of Lords Committee on the Hull Bill, we shall be abundantly compensated for the space and time devoted to this correspondence. Now as to the figures. We need not quote the statement made by Mr. Hunt in his Presidential Address to the Institution, because it was almost word for word in accordance with his evidence before the Lords Committee on the Hull Bill. This is what he said on the latter occasion, and we ask particular attention to the italicized words:

The Board of Trade returns for 1905 showed that the total capital indebtedness on gas-works account of the local authorities owning gas undertakings, after the deduction of sinking funds, was at the rate of £471 per million cubic feet sold, as compared with £712 in 1882. They also showed that the capital of gas companies had *increased during the same period from* £724 *to* £840 per million cubic feet sold. The latter figure was *largely attributable* to stock conversion by many of the companies; but as the local authorities had usually had to pay large sums for goodwill, *the comparison held good.*

We say that this comparison, as laid before the Lords Committee, does not hold good. If we analyze the figures given by Mr. Hunt in his present letter, what do we find—that, taking the 143 companies which he submits as comparable with a similar number of local authority undertakings, and deducting the amount added on conversion of stock, that, far from their capital per million cubic feet having increased, it has been reduced from £694 per million cubic feet in 1882 to £595 in 1905, and without the operation of a sinking fund. This gives a distinctly different impression from the statement made before an inexpert committee that "the figures also showed that the capital of the gas companies had increased during the same period from £724 to £840 per million cubic feet sold, &c." We do not think that Mr. Hunt will suggest that the difference between £595 and the £840 quoted by him before the Lords Committee—that is to say, £245 per million, or 37,738 millions, multiplied by £245—represents stock conversion in the case of the 143 companies he has chosen in compiling his present figures. If he does not, then there is no justification for the words we have italicized in the quotation from the report of his evidence. We cannot see any particular usefulness in the last figures of Mr. Hunt's table as to the total increase of capital since 1882, and the increase of capital per million cubic feet of additional gas sold. They do not show that the local authorities have provided for the increased consumption at any cheaper rate than the gas companies. All the total figures show is the salutary effect of the sinking funds from 1882, coupled to the good industrial day-demand for gas that most of the local authorities enjoy over provincial and suburban gas companies, the higher average consumption of gas per mile of main by nearly ½ million cubic feet, about 46 more consumers per mile of main, and other beneficial conditions owing to situation and general environment—most of which have greatly improved during the past quarter of a century. Mr. Hunt is to be thanked for having conclusively proved that there is a fairer way of presenting these figures as to capital than the one adopted by him in his evidence before the House of Lords Committee. So far as our correspondent wishes to emphasize the necessity on the part of companies of taking all legitimate means of reducing capital by writing off for depreciation and by proper allocation of expenditure between capital and revenue, we are in full accord with him.—Ed. J. G. L.]

The Gaslight and Coke Company's Rules for Workmen.

Sir,—The thanks of the gas profession are due to Mr. F. W. Goodenough, and to the Governor of the Gaslight and Coke Company (Mr. Corbet Woodall), for publishing in your columns the printed rules issued to the fitters and other men employed in the department controlled by Mr. Goodenough. Although the rules emanate from the largest outside department in the country, there is a good deal in them that can, with advantage, be reflected upon by those in control of the smallest. It is impossible for me to return thanks in the practical way of responding to the invitation for "further opinion or experience," for the rules appear to be already complete in every respect. As, however, I had the presumption to suggest their publication, I feel that it is due from me to express my personal indebtedness to Mr. Goodenough for his ready response.

Longwood, Aug. 5, 1907. Jno. Hy. Brearley.

Gas, Electricity, and Water Supply of Tunis.—According to the report presented at the last meeting of the Tunis Gas, Electricity, and Water Company, there was no increase in the consumption of gas last year; but that of electric current was much higher, as shown by the fact that the number of consumers rose from 383 to 519. More water was consumed in both the city and the suburbs; 300 additional consumers being placed on the books. About 418 million gallons of water were distributed last year, compared with 371 millions in 1905.

Gas Preferred to Electricity in Manchester.—The minutes of the Gas Committee submitted at last Wednesday's meeting of the Manchester City Council contained a memorandum respecting the rearrangement of the lighting of St. Peter's Square by incandescent gas-burners; and Mr. Kemp asked whether the time had not arrived for the substitution of electricity in the lighting of the public squares of the city. Alderman Gibson, the Chairman of the Gas Committee, replied that he would raise no objection to the lighting of the square being placed in the hands of the Electricity Committee, but the Gas Committee had already been put to considerable expense, and he intended St. Peter's Square to be one of the best lighted parts of the city. Alderman Copeland observed that, as far as street lighting was concerned, electricity had been proved to be inferior to gas. An amendment to refer the matter back to the Gas Committee was rejected by a large majority.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Metropolitan Water Board (Charges, &c.) Bill, Metropolitan Water Board (Various Powers) Bill.

Bill read the third time and passed: Llandrindod Wells Gas Bill.

Bills Royal Assented: Annfield Plain and District Gas Bill, Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water-Works Bill, Birkenhead Corporation Water Bill, Broadstairs and St. Peter's Urban District Water Bill, Coventry Corporation Water Bill, Gas and Water Orders Confirmation Bill (No. 2), Kingston-upon-Hull Corporation Bill, Portishead District Water Bill, Selsey Water Bill, Sheffield Corporation Bill, Tynemouth Corporation (Water) Bill.

HOUSE OF COMMONS.

Tuesday, Aug. 6.

METROPOLITAN WATER BOARD (CHARGES, &c.) BILL.

The consideration of this Bill, adjourned from the 23rd ult. (see *ante*, p. 331), was resumed to-day.

Mr. BURDETT-COUTTS moved an amendment to the clause sanctioning rebates in certain cases, to the effect that the benefit of the rebate be given to persons assessed from £200 per annum, instead of £300 as drafted in the Bill. He submitted that the change proposed by him would benefit a large class of shopkeepers and business men, who needed a rebate more than persons assessed for business premises at £300 per annum and upwards.

Mr. E. B. BARNARD (the Vice-Chairman of the Metropolitan Water Board) said the promoters could not accept the amendment for financial reasons. It was quite impossible for the Board to grant any more concessions.

Sir F. BANBURY, in supporting the amendment, remarked that a deficit could be met by a rate-in-aid.

Mr. BURNS said the amendment, if adopted, would have a serious effect upon the finances of the Board; and the inevitable effect would be that the poorer customers—those assessed at very much less than £200 per annum—would have to pay more than was proposed in the Bill. If the deficiency could not be covered in this way, a rate-in-aid would have to be incurred. He pointed out that the Committee who had considered the Bill had all the arguments before them, and had heard witnesses on every point which could be raised. After most careful consideration, extending over many sittings, they had decided that what the Board proposed to do in this matter was fair and equitable to everybody.

Upon a division, the amendment was rejected by 184 votes to 24.

Sir F. BANBURY moved an amendment to the same clause, to the effect that the rebate or discount instead of being from 20 per cent. to 30 per cent. be 30 per cent.

The amendment was negatived by 173 votes to 20.

On the clause dealing with supply by measure,

Mr. COOPER moved an amendment to the effect that the charge for any supply furnished by the Board under the provisions of the clause should be at the fixed rate of 8d. per 1000 gallons.

The amendment was negatived without a division.

An amendment to alter the clause relating to the supply of water for building purposes was negatived without a division, as was also one to strike out the clause dealing with the recovery of rates by action.

The debate was continued to an early hour on Wednesday morning; and at the close the Bill was reported for third reading.

Thursday, Aug. 8.

EXPORT DUTY ON COAL.

Mr. MARKHAM asked the Chancellor of the Exchequer whether, seeing that the present inflated prices of coal are injurious to the industries of the country and inflict hardship on small consumers, he will consider the desirability of appointing a Committee to inquire and report whether an export duty on coal could be imposed, without injury to the best interests of the trade, after the price of coal reaches a point which gives a fair return to the colliery owner on his capital and to the miner for his labour.

Mr. ASQUITH thought an inquiry of the kind suggested would not add anything to the information already available on the subject of an export duty on coal or its economic effect.

Mr. MARKHAM asked the right honourable gentleman if he was aware that coal was now fetching 21s. a ton at Cardiff which was being sold at 14s. a ton while the export duty was in force.

Mr. ASQUITH said possibly that was so.

The following further progress has been made with Bills:—

Bills read the third time and passed: Metropolitan Water Board (Charges, &c.) Bill, Metropolitan Water Board (Various Powers) Bill.

Award in the Wolstanton Gas Arbitration.—Mr. A. J. Ram, K.C., the Umpire in this arbitration, the proceedings in which were reported in the "JOURNAL" for the 30th ult. (p. 339), has made his award, as follows: For mains, pipes, and works, £9357; for severance, £895; and for loss of revenue, £11,124. The last two items are subject to the decision of the Court as to whether the Corporation of Burslem are entitled to recover anything in respect of severance or loss of revenue. The claim was for upwards of £32,000; and the total amount of the award is £21,376.

BIRKENHEAD CORPORATION WATER SCHEME.

House of Commons Committee.—Tuesday, July 23.

(*Before Mr.* ARTHUR STANLEY, *Chairman, Mr.* GOOCH, *Mr.* PEARSON, *and Mr.* HAWORTH.)

The Bill by which the Birkenhead Corporation seek power to obtain a supply of water from Wales came under consideration to-day. As deposited, it contemplated the construction of three reservoirs—the Alwen, the Brenig, and the Glan Alwen. In the course of the hearing by a Committee of the Upper House, presided over by Lord Newton, the extent of the scheme was somewhat reduced by directing the omission of the proposed Glan Alwen reservoir; and it was in this form that the Bill came before the Commons' Committee. The only opponents now were the Corporation of Liverpool, the Chester County Council, the Chester Water Company, the Wirral Rural District Council, and the Wirral and West Cheshire Water Companies.

The consideration of the Bill had been delayed in consequence of the action of the Board of Trade, who, in view of the possible injurious effect upon the navigation of the tidal portion of the River Dee by the abstraction of water from its tributaries, appointed Mr. L. F. Vernon-Harcourt, M.Inst.C.E., as an Inspector to inquire and report to them (1) as to what extent, if at all, the proposed works and abstraction of water sought to be authorized by the Bill were likely to affect injuriously the navigation of the tidal portion of the river; (2) whether such injury could be prevented or remedied by dredging or other works; and (3) what would be the probable annual cost of the same, and by what authority they would be best carried out. Mr. Vernon-Harcourt reported at some length on the questions submitted to him, and came to the following conclusions: "(1) I consider that, in the present condition of the tidal Dee, any abstraction whatever of fresh water would be, in proportion to its amount, injurious to the river. (2) I am of opinion that any injury caused by the proposed abstraction of fresh water by the Birkenhead Corporation could be remedied by dredging. (3) I estimate that the cost of the dredging necessary to remedy any such injury would amount to £316 a year; and I think that the body most fit to undertake the work would be the Dee Conservancy."

Mr. BALFOUR BROWNE, K.C., the Hon. J. D. FITZGERALD, K.C., and Mr. GERALD FITZGERALD appeared for the promoters; Mr. WEDDERBURN, K.C., represented the Corporation of Liverpool; and Mr. SQUAREY the Wirral Rural District Council.

The CHAIRMAN, at the outset of the proceedings, referred to the delay in the consideration of the Bill at the request of the Board of Trade.

Mr. BALFOUR BROWNE said that when the Committee knew the circumstances of the delay, and what had happened, they would see that, though some expense might have been caused thereby, on the whole it had been of advantage, inasmuch as it had resulted in a very satisfactory arrangement being arrived at with the River Dee Conservancy. He then related the circumstances which had convinced the Birkenhead Corporation that the time had arrived when they should seek to obtain an independent, and, if possible, a gravitation source of water supply; and he referred to inquiries into the question which had been made by a Committee of the Corporation, and which culminated in a report from Dr. G. F. Deacon recommending the present scheme. He also described the negotiations which had taken place between 1903 and 1906 with the Liverpool Corporation, and their failure (though they had proceeded so far that heads of agreement were arrived at between Committees of the two Corporations), owing to the refusal of Liverpool to enter into an undertaking to give Birkenhead a permanent and unlimited supply of water. It was only after the failure of these negotiations that Dr. Deacon's scheme was finally adopted by the Birkenhead Corporation. The learned Counsel then outlined the scheme, as fully explained by him in the proceedings before the Committee of the House of Lords, already reported, and pointed out the changes made in the Bill, the effect of which was, he said, to cut down the scheme, and diminish the abstraction of water from the Dee. The dry-weather flow, if the Corporation had not promoted this scheme, would have been 1,221,846 gallons a day. It was originally proposed to increase it, by means of compensation water from the reservoirs, to 4,652,517 gallons; but, as the Committee of the House of Lords raised the proportion of compensation water to one-third, the minimum flow would now be 6,203,557 gallons. It had to be borne in mind that they were not affecting the whole drainage area of the River Dee. The total drainage area of the Dee was 675 square miles; and they were affecting only 17·69 square miles. The flow of water over the weir at Chester was 750 million gallons a day. The total abstraction, when all the Corporation works were completed, would only be about 12½ million gallons. Counsel then passed on to refer to the petitions against the Bill. Dealing first with that of the Chester County Council, who objected to the permissive nature of clause 56 ("Power of Corporation to Supply Local Authorities, Companies, or Persons"), he said they entirely objected to be put under a compulsory obligation to supply people on the route of the viaduct, as it would be making Birkenhead the water authority for the whole of the district through which the pipe ran. As to the petitions of the Water Companies, the Corporation objected to supply them with water, as they demanded, at cost price. The only effect of this would be to enable them to secure larger profits at the expense of the consumers of Birkenhead, on whom this scheme would throw a slightly increased charge for water as compared with what they were paying now. The essence of the opposition of the Liverpool Corporation was contained in the following paragraph of their petition: "Your petitioners strongly object to the conferring upon the Corporation of any powers to supply water within the area already assigned by Parliament to your petitioners, and particularly within the area of the Urban District Council of Wallasey, as your petitioners have entered into an agreement with that Council for a supply of water in bulk; and the granting of the powers contained in section 56 of the Act would cause serious loss and inconvenience to your petitioners." His comment upon this was that the area referred to was not assigned to the Liverpool Corporation at all. It was only an area in which they might supply by agreement. It was not part of their water area, as Birkenhead was part of the Corporation's water

area. The Vyrnwy Act only gave the Liverpool Corporation permissive power to supply water *en route* if the people chose to take it from them; and they were prohibited from going into any person's district without the consent of the local authority or company supplying. He was perfectly willing to recognize the agreement the Liverpool Corporation had made with Wallasey. It purported to be in perpetuity; but it could be put an end to by five years' notice. He was not going to recognize any other right of Liverpool to supply Wallasey.

Mr. WEDDERBURN: Are you ready to say that you will not supply Wallasey as long as we are willing to do so?

Mr. BALFOUR BROWNE said he was not. He thought it would be an improper thing for him to bind himself in no circumstances to supply Wallasey; and he believed it would be a very good thing for her to have two strings to her bow. Passing to the petition of the Chester Water Company, Counsel said that Birkenhead was there referred to as "only a suburb of Liverpool." "This," he said, "is only meant to insult us." Birkenhead is not a suburb of Liverpool. His comment on the joint petition of the Wirral and West Cheshire Water Companies was that the Corporation did not intend to compete with any water company who were actually supplying in an area.

Evidence was then given for the promoters.

Alderman *Bloor*, the Chairman of the Gas and Water Committee of the Birkenhead Corporation, said the Committee considered every scheme that anybody could think of, including the possibility of getting a supply of water from Manchester and Liverpool. They exhausted every reasonable source of supply nearer home before embarking on the present scheme. The Corporation consulted Sir Alexander Binnie, Professor Boyd Dawkins, and other experts; and their reports entirely justified the recommendations of Dr. Deacon. There was no desire on the part of the Corporation to compete with Liverpool in the supply of water to places on the route of the proposed viaduct; nor did they wish to interfere between Wallasey and Liverpool.

Mr. WEDDERBURN: Are you content, so long as Liverpool is able and willing to supply Wallasey, that you will not interfere?

Witness: I do not go so far as that; but as long as the present agreement remains in existence, we have no wish to disturb it.

You do not desire to be in the position of inducing Wallasey to give notice to Liverpool when otherwise they would not do so?—We desire to be in a position to supply water if circumstances should make it mutually advantageous. We have no wish to induce Wallasey to leave Liverpool.

Would you be willing to come to such arrangement as this—that Liverpool should say that, where you had agreed to supply to any particular local authority or person, Liverpool would not compete with you in regard to that supply so long as you were ready to continue it; and that you, on the other hand, should say that where Liverpool agreed to supply any local authority or person you should not come in?—I would not like to answer that question. I am only one individual, and I am not authorized in this respect to speak on behalf of the Corporation.

Although there is a risk to Liverpool as regards Wallasey, Liverpool is to have no protection?—The risk is so slight that I think they need not trouble themselves about it.

In answer to Mr. SQUAREY, witness said that if the Bill became law, the Corporation would be under compulsion to supply all the districts in regard to which they had made agreements. He was not prepared, however, to put in the same position those authorities on the line of the viaduct with whom agreements had not already been made.

In re-examination by Mr. FITZGERALD, witness said he recollected Lord Newton saying in the other House that he was agreeably surprised at the moderation of Birkenhead with regard to Liverpool, and that it seemed to him that Liverpool had no better right in the Wirral Peninsula than Birkenhead.

The CHAIRMAN: The construction you put on clause 56 is that you will not supply water within the area of any local authority or company without the consent of that local authority or company?

Witness: That is so.

Do you hold that this entirely covers any question of competition?—That is our contention.

About this agreement between Wallasey and Liverpool, I understand it is meant to be a permanent agreement, but it is terminable on five years' notice on either side, and the cost of the main is to be borne by Wallasey and spread over 30 years?—If Liverpool terminates the agreement, Liverpool would have to return the money already paid by Wallasey in respect of the main. If Wallasey brings the agreement to an end, Wallasey will have to continue to discharge its obligations with regard to the main.

So that neither side can break the agreement for 30 years without suffering financial loss?—That is so.

Sir *Thomas Stevenson* spoke of the salinity of the wells from which the present water supply of Birkenhead is derived, and expressed the opinion that the Corporation had done a prudent thing in coming for a pure supply of water such as the scheme contained in the Bill would provide.

Wednesday, July 24.

On the resumption of the inquiry this morning,

Mr. WEDDERBURN, referring to Alderman Bloor's reply to the Chairman on the previous day, that neither Wallasey nor Liverpool could break the existing water agreement without suffering financial loss, said this was a mistake. Liverpool could not do so, but Wallasey could.

The CHAIRMAN: Liverpool would have to pay for the mains?

Mr. WEDDERBURN: It goes farther than that; but I will explain the position fully at a later stage.

Mr. *Benedict Jones*, the Chairman of the Parliamentary Committee of the Birkenhead Corporation, gave evidence confirmatory of Alderman Bloor's statements as to the character of the present well water and the necessity for obtaining a fresh supply. He said he had himself pressed this necessity upon the Council for more than ten years. The town was unanimously in favour of the present scheme. The whole of the local authorities along the line of pipe who were not within a company's water area had been agreed with by the Corporation. The works and viaduct were situated in Denbighshire and Flintshire; and the Councils of these counties were satisfied.

The CHAIRMAN: Do I understand that you have agreed to give a supply of water to all the small local authorities on the line of your aqueduct from the works to where it crosses the Dee?

Witness: Yes, with all who have asked us. I think I can safely say that we have covered the whole of the ground except Connah's Quay and Buckley, which are under Companies. With these exceptions, all local authorities who have applied to us have the same agreement at 6d. per 1000 gallons; but the whole of them only come to a maximum daily demand of half-a-million gallons.

Dr. *G. F. Deacon*, the Engineer of the scheme, said it was the only available one for Birkenhead, without following the circuitous route of the River Dee. The quality of the water was perfect, except that in the case of the Alwen there was the drawback of the presence of peat beds. Arrangements had been made to remove the peat which was in the reservoir area, and to drain the rest, so that the water would be quite white before it reached Birkenhead. Having repeated the figures given by Mr. Balfour Browne as to the size and capacity of the reservoirs and the length of the aqueduct, witness passed on to the cost of the scheme. He said the estimate for the Alwen reservoir and the first line of aqueduct was £758,252. This included lands and easements for the completed works. The estimate for the Brenig reservoir and the second line of pipe was £530,000. The first figure worked out at £108,320, and the second at £101,845, per million gallons per day, which was, by comparison with other similar schemes, a low cost. The growth and development of Birkenhead would, according to his calculations, necessitate the construction of the Brenig reservoir not later than 1921. Taking the whole scheme, they were, at the very outside, looking only 44 years ahead in the matter of water supply. Dealing with the petitions, witness said the Chester Water Company would be greatly benefited by the increased dry-weather flow of the river which would result from the compensation water sent down from the reservoirs. It was not true that the Chester Water-Works would not get the compensation water. As to the petition of the Liverpool Corporation, there was no intention to interfere with the existing contract between Wallasey and Liverpool.

In cross-examination by Mr. WEDDERBURN, witness said there was no doubt in his mind that the Wallasey agreement was not to be interfered with; but if the Wallasey people chose to exercise their prerogative, and give up the supply from Liverpool, he did not see why they should not do it.

Mr. WEDDERBURN: Supposing Birkenhead found they had surplus water, do you think it fair that they should say to Wallasey, "We will supply you at less than the price at which you are getting your supply from Liverpool and at which we are supplying our own people," so as to persuade Wallasey to come away from Liverpool?

Witness: I think it would be very wrong to impose a condition of that kind—to limit the price by reason of the supposed cost of the water to Birkenhead.

Would it be a right and fair thing to sell at a loss?—If Birkenhead could afford to do so, I do not see why they should not do so.

At a very low price?—I think at such a price as they can afford, having regard to all the circumstances.

Mr. MOON, K.C., for the Chester Water Company, questioned the witness in considerable detail for the purpose of showing that he had over-estimated the rate at which the population of Birkenhead would increase, and on which he had based the period of duration of the water supply, and also that the estimate of consumption of 41 gallons per head of the population was higher than any other town in the country similarly situated to Birkenhead. Mr. Deacon refused to assent to either of these propositions. In regard to the first, he gave it as his opinion that the rate of increase of population in Birkenhead would not diminish during the next fifty years; while as to the second, he quoted figures to show that the water consumption per head was larger in many towns than he had estimated for Birkenhead.

Mr. BALFOUR BROWNE (to witness): Your attitude with regard to Wallasey is, that if they cease to take water from Liverpool, they should have an opportunity of agreeing with you if they choose; and with regard to Wirral, you want them to be free to agree with you if the Companies consent?

Witness: Certainly.

You do not propose to compete with the companies supplying water in detail?—Certainly not.

And the only competition you are speaking of is between two authorities who are not compellable to supply, but can supply in bulk?—Certainly; and I think that is fair.

In reply to Mr. WEDDERBURN, witness said an old calculation of his showed that the cost of bringing water to Birkenhead from the Alwen reservoir alone in 1916 would be 5·2d. per 1000 gallons. This figure would now be modified by the inclusion of Chester and the other outsiders. In 1936, when the Brenig reservoir would have been constructed, the cost would be 6·2d. per 1000 gallons. He could not possibly say what the cost of the bulk supply would be.

Thursday, July 25.

On the re-assembling of the Committee this morning,

Mr. FITZGERALD stated that the proportion of the estimate for the Alwen supply which related to the works from the source down to the nearest point to Chester was £603,644, and for the complete works £1,003,000.

Sir *Alexander Binnie* said he had made himself acquainted with the scheme prepared by Dr. Deacon. The sizes of the reservoirs were remarkably good, both from the engineering point of view as to construction and for the purity of the water they were likely to impound. The scheme presented no engineering difficulties whatever. He corroborated Dr. Deacon's evidence as to the effect of the compensation water, which, by the decision of the Lords' Committee, was a larger proportion than had been given in the other Welsh water schemes, on the flow of the Dee, and as to the deterioration of the present sources of supply owing to the increasing salinity of the local wells.

In reply to the CHAIRMAN, witness said he was not of opinion that the Chester Water Company would be adversely affected by the dimi-

nution in the flood water. It would be an advantage to them to have in dry weather a large quantity of water sent down to them which they did not get at the present time.

Mr. *G. H. Hill* also expressed approval of the scheme.

Mr. FORBES LANKESTER at this point intimated that the opposition of the Chester Water Company was about to be withdrawn.

Mr. FITZGERALD said that with the withdrawal of the Chester Water Company the remaining opponents were contesting the Bill on points which were substantially clause questions, and therefore he did not think he ought to take up any further time with evidence.

This closed the case for the promoters.

Mr. SCOTT addressed the Committee in the interests of the Wirral and West Cheshire Water Companies, who asked that they should be protected by name against the competition of the Birkenhead Corporation. His suggestion was that a sub-section should be introduced providing that the Corporation should not supply water so as to be used within the limits of supply of the Companies, otherwise than by supply in bulk to the Companies, or with their consent in writing, both to be mentioned specifically by name. Without such protection he feared there would be a temptation on the part of the Birkenhead Corporation to supply in competition with the Companies.

Mr. SQUAREY, on behalf of the Wirral Rural District Council, said they opposed the Bill on three grounds: (1) That there was insufficient protection to them as the sanitary authority in respect of their sewers; (2) that there was an absence of any undertaking or agreement to supply them with water in the event of the two Companies consenting to their being so supplied; and (3) the price which they ought to pay for such a supply. So long as the existing Companies had water enough for the population of Wirral, they would, of course, continue to supply them. But they had it on the authority of Dr. Deacon, Sir Alexander Binnie, and Mr. Hill, that the present sources were precarious, and when the supply failed the District Council must look elsewhere for water. It was obvious that when that time arrived they must look to Birkenhead; and what they asked for now was that they should be placed on exactly the same footing as many other people had been by the Birkenhead Corporation.

Mr. CLEASE asked that the Chester County Council, for whom he appeared, should be invested with the right to demand, on the failure or inability of an authorized company, or the failure of a local authority, to afford it, a supply of water from the Birkenhead Corporation, on terms which should not be onerous. He asked the Committee, if they passed the preamble of the Bill, to put an obligation upon the Corporation to supply any local authority within five miles of the aqueduct and in the county of Chester with water if they demanded it, and providing that the amount to be paid by the authorities should either be fixed by arbitration or be such as Chester herself paid.

The case for the Liverpool Corporation was then opened.

Alderman *Burgess*, the Chairman of the Water Committee of the Liverpool Corporation, in answer to Mr. JEEVES, stated that the Wallasey people were in considerable straits as to their water supply, and, though Liverpool had not then completed the laying of the second pipe line from Vyrnwy, the Corporation decided to relieve the anxieties of Wallasey by undertaking to furnish them with a minimum daily supply of 500,000 gallons, and a maximum daily supply of 2,500,000 gallons. The price fixed was 6d. per 1000 gallons. The Corporation borrowed £105,000 for the cost of the main, and Wallasey undertook to repay the amount over a period of thirty years. The Corporation were liable for the rates on the main, which amounted to about £500 a year. The agreement was for a period of thirty years, terminable on five years' notice on either side. But, in order to make the position as permanent as possible, it was provided that if, within the period named, Liverpool should give notice, they were to pay the whole cost of the main. The Corporation would then have to return to Wallasey all the payments made by them in respect of sinking fund and accumulated interest, and would be penalized to the extent of £107,000. On the other hand, if Wallasey chose to determine the agreement, they were at liberty to do so; and in such event they merely had to pay cash down for what, under the agreement, they had paid by instalments. In reply to further questions, witness said Wallasey was only taking now the minimum of half-a-million gallons; but the Liverpool Corporation were obliged to hold in reserve for them an additional 2 millions. If the time ever came when Liverpool could not afford to give their supply to Wallasey, it would be necessary to go for more water for Liverpool.

Mr. JEEVES: Do you consider that, having come to the help of Wallasey in their time of need, you ought to have such provision inserted in this Bill as shall protect you against a scheme that could not have been thought of or considered when you went to the relief of Wallasey?

Witness: I think so. So long as we are able to supply Wallasey from the line of pipe, I think we ought to be protected.

In answer to the COMMITTEE, witness said, supposing Wallasey were to break the agreement, quite apart from any profit that Liverpool might get from the 6d. per 1000 gallons, he thought Liverpool would not lose any money.

Mr. *Joseph Parry*, the Engineer-in-Chief of the Liverpool Corporation Water Department, speaking of the Wallasey agreement, gave it as his opinion that it would not be fair that Birkenhead should now come in and have a right to compete with the Liverpool Corporation in the supply of water in the Wallasey area; nor did he think it would be wise from the point of view of public policy. Having given Wallasey a supply in pursuance of the agreement, he thought Liverpool ought to be protected, so that they might get from it the benefit they had a reasonable right to expect. If the Wallasey main were to become of no value in the supply of water, the capital which had been expended upon it would be wasted; and this would throw a burden on the ratepayers of Liverpool. He would like to point out to the Committee that the agreement really meant that, Wallasey having been in difficulties with regard to its water supply, was secured now to the extent of 3 million gallons a day at the expense of Liverpool.

Mr. WEDDERBURN then addressed the Committee on behalf of the Liverpool Corporation, who, he said, had desired all through to be fair in this matter both to Birkenhead and to Wallasey. He thought there could be no question in the minds of the Committee that this was a Bill to supply Birkenhead, and not one to constitute the Birkenhead Corporation the water authority for places other than Birkenhead. What the Corporation were seeking was power to supply, if they thought fit, places which were not along the line of route. He did not think it could fairly be said that the bargain which Liverpool made with Wallasey was a hard one, or anything like it; nor could it very well be said that Wallasey was in any sense discontented with it. Liverpool could only terminate the agreement at the cost of taking over the main; and having taken it over, they were prevented from using it to supply any other authority. Therefore the agreement, so far as Liverpool was concerned, was clearly intended to be a permanent one. The question for the Committee was: Was there any danger of this Birkenhead proposal adversely affecting Liverpool in regard to Wallasey? The risk was that if Liverpool was not protected, Birkenhead might at once undersell her, and so induce Wallesey to give up the agreement. It would be against public policy to refuse protection against such a risk, because of the sense of insecurity it would give. The principle of competition between water authorities had never received the assent of Parliament. He therefore asked the Committee to exclude Wallasey. If they were with them on the principle that there should be no competition, he asked them to go further, and say there was to be no competition in regard to agreements once made. Thirdly, he asked that Birkenhead should not be allowed to supply outside places at a cheaper rate than they charged inside.

The case for the opponents then closed.

The Committee having deliberated,

The CHAIRMAN said: We find that the preamble of the Bill is proved, subject to the insertion of the sub-clauses submitted by the Wirral and West Cheshire Water Companies for their protection, and subject also to a proviso that Birkenhead shall not at any time before 1930 supply water to consumers in Wallasey at a cheaper rate than is at that time being paid by consumers in Birkenhead. This leaves the question of disturbances of mains and sewers to be raised on clauses.

Mr. FITZGERALD: If you say "at a cheaper rate than is supplied in bulk in Birkenhead," that is fair; you are comparing two things that are alike. But if you mean that the actual charge made to the individual consumer in Birkenhead is to be the guiding principle, there would be a difficulty.

Mr. WEDDERBURN: I think we see what the Committee mean, and will be able to come to an agreement.

The next day the clauses were adjusted, and the Bill was ordered to be reported.

Additional Capital for the Northampton Gas Company.—At the conclusion of the annual general meeting of the Northampton Gas Company last Thursday, at which a dividend at the rate of 5 per cent. per annum was declared on the consolidated stock, the Directors were authorized to raise £20,000 of additional capital.

Hereford Ironmongers and Gas-Fitters and the Gas Committee.—At the monthly meeting of the Hereford Town Council last Tuesday, a petition was presented from the ratepayers trading as ironmongers and gas-fitters, complaining that a circular issued by the Gas Committee with respect to the maintenance of incandescent gas-lights was a serious attack on their businesses, and likely to give rise to unjustifiable competition. They stated that a scheme on similar lines had been provided by private enterprise, and had been in operation for several years. The matter was referred to the Gas Committee.

Incandescent Gas Lighting at Leatherhead.—At the annual meeting of the Leatherhead Gas Company last Wednesday, the Chairman (Mr. F. H. Williams) mentioned that since the previous meeting a five years' contract had been entered into with the Leatherhead Council for the public lighting, at the rate of £3 6s. 6d. per lamp per annum—a reduction of 2s. per lamp, on the former rate. One of the conditions of the contract was the conversion of the remaining 36 flat-flame burners to the incandescent system. This had been done, and he thought the shareholders would agree with him that the whole place was very well lighted.

Tar Painting for Roads.—At the meeting of the Hereford Town Council last Tuesday, the Roads Committee recommended the tar painting of the surface of a certain road, as they were informed that the cost of watering and scavenging would thereby be reduced to such an extent as to justify the slightly increased first outlay. The City Surveyor (Mr. J. Parker), on being asked his opinion on the matter, said his mind had been made up for some time. There was no question about tar macadam and tar painting very materially increasing the life of the road; and in the end the cost—spread over a period of six or seven years—would be cheaper. It would save the scavenging and water, and the places already done did not take half so much watering as the others. Tarred roads were bound to come, not on account of the dust nuisance, but of the extra repairs. It did not cost 1d. a square yard to do, and it nearly saved itself in one year. The recommendation was adopted.

Aldershot Gas and Water Supply.—At the half-yearly meeting of the Aldershot Gas and Water Company on the 2nd inst., the Directors reported that the revenue in the six months ending the 30th of June was £27,588, and the expenditure £20,119; leaving a surplus of £7469. After providing dividends on the preference shares and interest on the preference stock, mortgage, and debentures, the Directors recommended dividends at the rates of £11 19s. and £8 19s. per cent. per annum on the shares subject to the sliding-scale, and at the rate of 7 per cent. per annum on the ordinary shares, less income-tax. In the course of his remarks when moving the adoption of the report, the Chairman referred at some length to the rise in the price of coal, and hinted that this might mean an increase in the price of gas; but hopes were held out that no advance would be made in the near future. With regard to water, the Chairman expressed his pleasure in congratulating the proprietors in respect to the security of the supply and the maintenance of its purity. The report was adopted, and the thanks of the meeting were accorded to the Chairman, Directors, staff, and servants of the Company for their services; the compliment being acknowledged by Mr. W. T. Robertson and the Secretary and General Manager (Mr. R. W. Edwards).

MISCELLANEOUS NEWS.

SOUTH SUBURBAN GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Friday, at De Keyser's Royal Hotel, Victoria Embankment, E.C.—Sir George Livesey in the chair.

The Secretary (Mr. Chas. M. Ohren) read the notice convening the meeting; and the Directors' report and the statement of accounts were then taken as read.

A Prosperous Half Year Improves Financial Condition.

The Chairman, in moving the adoption of the report and accounts, said he would first deal with the latter. The accounts, the Directors said, were satisfactory—in fact, he might say they were very satisfactory, because the coal carbonized was supplied at last year's prices through nearly the whole of the half year; and they had had the benefit of the increased value of coke during the whole of the half year. What had they done with the money? The Directors told the proprietors that there was a slight increase in the amount carried forward. In the previous half year, they had not quite sufficient profit to pay the dividend and interest; while in the current half year there was a considerable surplus. The Directors had partly devoted this surplus to increasing the insurance fund, making it £20,113. The fund was granted by Parliament to enable the Company to meet any extraordinary or unexpected accident—for instance, such a thing might happen as an explosion of gas, and some valuable premises might be wrecked. If, in such an event, the Company had not a fund from which to meet such an unavoidable thing as this, it would seriously affect their dividend. He did not think that £20,000 was a penny too much for this purpose. They were allowed by Act of Parliament to accumulate an insurance fund equal to 5 per cent. on the cash capital raised; and as this was £470,000, they were entitled to have £23,500 as an insurance fund. The Directors had also taken advantage of the prosperous half year to put the interest of the reserve fund to the credit of the fund. It would not be at all a bad thing if the reserve fund were brought up to 10 per cent. on the paid-up capital—that was, the cash capital. The reserve fund now stood at £43,000; and £4000 was wanted to bring it up to the 10 per cent. When this was done he thought the Company would be in as safe a position as possible in regard to their funds. The Directors had done something else. They had in the December half year a suspense account in the balance-sheet of £6697. Of this amount, £5000 was due to the extension and alteration of one of the retort-houses. Part of the expenditure on the house was paid from capital, and part of it ought to come out of revenue. They could not meet it out of revenue in the last two or three years, which were short in profit; and so £5000 was carried to suspense at Dec. 31 last. There was also £1697 put to suspense for trucks. They had now paid off this £6697; and so the suspense account was cleared off altogether. After doing this, they had slightly more to carry forward than they brought forward.

THE EFFECT OF THE INCREASED PRICE FOR GAS.

It might be said, Why increase the price of gas, with a surplus such as they had had on the half year? As he had already explained, the surplus was due to coal at last year's prices, and coke at this year's prices. The new contracts for coal began to run towards the end of last half year at such increased cost that the Board did not feel it was a proper thing to deplete their reserve fund to make up the extraordinary additional expenditure so caused. The Directors therefore resolved that the price of gas must be increased. The effect of this on the proprietors would not be serious. At the price of 2s. 5d. per 1000 cubic feet, the proprietors were entitled to a dividend of £5 13s. 4d. per cent. But as £5 13s. 4d. per cent. was not earned in the previous half year, they did not pay it. In the past half year, they did earn it; but inasmuch as the Directors would not be able to pay the same dividend in the December half, they certainly did not feel justified in paying £5 13s. 4d. on the present occasion, to reduce it next time. Seeing, however, that they were only paying 5½ per cent., though entitled to £5 13s. 4d., the increase of price would have the effect of reducing the dividend to £5 6s. 8d., or 3s. 4d. per cent., or about £1008 a year. This was what the shareholders would actually have to give up in consequence of the increased cost of coal. If they were, on this occasion, to pay the full dividend to which the proprietors were entitled, the loss to them next half year would have been about £2016. The consumers lost by the increased cost of coal by having to pay a larger price for gas; the proprietors lost by having a smaller dividend. Then there was the third party in the partnership—the employees. They also lost. The sliding-scale system had been extended to them. The employees received on their salaries or wages a certain percentage bonus dependent on the price of gas. If (just as with the dividend of the ordinary proprietors) the price of gas went up, the bonus went down; if the price of gas went down, the bonus went up. The effect was this: The co-partnership year ended with June; and for the past year £3075 had been distributed among the employees, at the rate of 6½ per cent. on their salaries and wages. The increase of the price of gas would reduce the bonus from 6½ per cent. to 5 per cent.; and they would lose £700 a year. But he must remark here that the employees had always received the full bonus to which they were entitled; the shareholders had not always had their full dividend. What would be the effect of this? It was commonly said that there was a great deal of unrest among workmen; and that it was all very well so long as they were going on all right, and the full bonuses were being paid. But, people also commonly said, supposing the tables were turned; and there was a loss to the employees, they would begin to grumble, and the system would fail. His reply to that was this: The present was not the first time an increase in the price of gas had taken place since the co-partnership system was started. There was an increase of the price of gas in the year 1900; and a reduction of the proprietors' dividend and of the employees' bonus followed. The proprietors and the employees took the matter sensibly, and like men. There was not a word of complaint; neither would there be now. In fact, far from that, all parties had received the little reverse in the right spirit. He knew he could speak for the proprietors and for the employees, as well as for the consumers, because the Directors issued a notice as to the increase of price, with an explanation of the cause, to every one of their 36,000 consumers, and not one of them had complained. As Britishers they might, he thought, congratulate themselves that their people quite understood a position that was reasonable; and the best course the Directors had found to adopt in such a matter was to explain the whole thing—to be perfectly open and above-board—and tell consumers, employees, and proprietors exactly how the matter stood. He should be very much surprised if there was now any discontent or grumbling. They one and all accepted the fact, and hoped for better times.

THE POSITION OF THE COAL MARKET.

The coal market, he was sorry to say, had not improved since the Directors made their contracts. Instead of coal getting cheaper, it was much dearer. They made their contracts about three months ago; and the price of coal f.o.b. at the pit had gone up something like 2s. a ton in the three months. What was going to happen, one did not know; but one had a right to protest against the course that was being pursued by Parliament. There were two parties very active, and very much interested, in getting a higher price for coal—the coal owners and the coal miners. The remark had been made: "Gas shareholders get large dividends; let them give up a portion of their dividend for our benefit, and let the consumers pay more for their gas." He did not know of any body of men more capable of looking after themselves and their interests than the coal owners and the miners; and the danger was, while these people were ever watching to get all they could, the most important body of people in the kingdom, the only body that counted—that was, the consumers of coal—were left out of consideration altogether. What was Parliament doing now? They were introducing Eight-Hour Bills for coal miners. A Committee sat at the beginning of the year to inquire what would be the effect of an Eight-Hour Bill on the price of coal. A great deal of evidence was given before the Committee; and it was made pretty clear that an Eight-Hour Act would increase the cost of getting coal. A representative of one of the most important miners' unions told a friend of his (the Chairman's) that coal ought to be at least 30 per cent. higher than it was (this was only a few months ago), in order that coal owners and miners might get, as he called it, a fair profit. But so far as the miners were concerned, the larger pay they received, the less work they did. Coal owners had told him that the men would not work a full week; and when wages were high, they worked still less time. Why these men should want Parliament to limit their hours to eight per day, when perhaps they worked only four days a week, was beyond his comprehension. But this eight-hour movement was a purely socialistic one; it was prompted by the Socialists. He (the Chairman) was on the Labour Commission some years ago; and a good many of the witnesses came before the Commission, advocating an eight-hour day. The question was asked, Why an eight-hour day? And some of the witnesses were candid enough to say, "In order to absorb the unemployed." Their friends of the Gas-Workers' Union had said the same thing; and the Secretary of the Union said only the other day in the House of Commons: "By establishing a universal eight-hour day, the unemployed would be absorbed." When on the Labour Commission, he (the Chairman) put this question to a witness: "Supposing you get an eight-hour day, and supposing after that there were still unemployed men, what would you do?" The answer came promptly: "We would reduce it to six hours." Then he (Sir George) followed that up, and said: "Supposing you have a six-hour day; and there were still unemployed, what would you do?" "Then we would reduce to four," was the reply. Mr. Tillett himself said he would reduce the day to four hours; and he would compel the rich people to work a four-hour day also. That statement did not appear in the report of the Commission's proceedings. The witnesses had an opportunity of revising their evidence; and the other day he (Sir George) was looking for this statement and could not find it. As he had said, the eight-hour day was a purely socialistic movement. He was satisfied that there were few people in the kingdom who had followed this matter so closely as he had done; and the farther he went, the more clear did it become that it was all part of the scheme to enable the Socialists to appropriate the property of other people. As to giving the miners an eight-hour day, what effect would that have for them? They could take an eight-hour day, without an Act of Parliament, if they liked; they were masters of the situation. However, meantime we were suffering. This Eight-Hour Coal Miners' Committee, he was glad to see, in their report, drew special attention to the party most interested in the matter—the consumer—and they advised Parliament, in legislating for one party, to take care that they did not neglect the interests of the great bulk of the people.

THE "FURTHER STAGE" REACHED.

He should have something to say about their own employees at the extraordinary meeting to follow this one. Whatever might be the case in regard to other concerns, they were happy among themselves. Practically, all their employees were proprietors holding in the aggregate a large amount of property in the Company; and this fact rendered a strike, or anything like it, impossible. In "The Times" for Aug. 5, he read this paragraph:

> Professor J. H. Merivale delivered on Saturday his presidential address to the North of England Institute of Mining and Mechanical Engineers, at their meeting in Newcastle-on-Tyne. He dealt with the relation of the miners to capital, and said the sliding-scale and the Conciliation Board were perhaps not the most perfect means of settling industrial disputes. But, under their guidance, there had not been a general strike in Durham for more than fifteen years, and in Northumberland for more than 20 years. They were *the best methods possible* at the stage they had now reached in industrial evolution, and could not be improved, except in detail, until *a further stage was reached*, when the identity of the interests of capital and labour being recognized by everybody, as it was now by the few, disputes between capital and labour would be impossible.

This was the position, he thought he might say, that they had already reached in this Company. The identity of the interests of capital and labour were recognized by them; and disputes between capital and

labour had with them become impossible. Men could not strike against themselves. There was no possibility of a strike or any serious dispute. They had made their men partners; and last year the employees received £3075. This had the further advantage that it tended to the distribution of wealth. The great cause of unrest in the labour market was that it was felt by working men that they were not getting their fair share of the wealth produced in the country. In their Company, they were trying to make their men owners of property; and if everybody did this, there would be very little chance for Socialism.

The Deputy-Chairman (Mr. Robert Morton), seconding the motion, said he did not think it required any remarks from him.

A Shareholder's Comments.

Mr. John Boraston remarked that the striking points of the Chairman's address seemed to be the fairness with which the Board endeavoured to deal with the interests of the ordinary shareholders and the employee shareholders and co-partners, and the general common-sense which characterized the proceedings of the Directors. He had been particularly struck with what the Chairman had said with regard to the spread of Socialism and the connection of the eight-hour movement with that particular creed. He was convinced that the Company's scheme of co-partnership provided the best possible means of meeting the wave of Socialism which to-day was a menace, not only to the country's industrial prosperity, but he believed to its moral well-being. As to the new co-partnership scheme, this was the natural outcome of the great success of the original experimental scheme. It had been prepared with most elaborate care, and provided for all possible contingencies. The accounts which had been presented were absolutely satisfactory. There was one subject in his mind which was not strictly germane to the report—that was the prosecution recently instituted by the Lewisham Borough Council against the Company for causing effluvia in the manufacture of gas. They were a Company engaged in the manufacture of a commodity which was absolutely essential for the production of those two great necessities of modern life—artificial light and heat; and so long as they carried out their chemical and other processes with a due observance of those precautions against nuisance which the scientific knowledge of the age had placed at their disposal—so long ought they to be free from interference. It seemed apparent to him from the reports he had read that, if the case succeeded against them, it might hamper the Company materially in their very necessary industry. He did not think it would succeed; and quite apart from the technical objections taken on the part of the Company, he believed that the saving words of section 21 of the Public Health (London) Act, 1891, would in themselves be sufficient to clear the Company from any legal responsibility. He thought the words were something like this: "Unless it is shown that such person has used the best practicable means for abating the nuisance, or preventing or counteracting the effluvia." He should like to recognize the admirable nature of the evidence of their Engineer, Mr. Shoubridge, and the excellent manner in which it was given. He heartily supported the adoption of the report, and congratulated the Board on the accounts they had presented.

The Question of Nuisance.

The Chairman said, with reference to Mr. Boraston's closing remarks, he believed this was the position regarding gas companies and the question of nuisance: Undoubtedly while Parliament compelled the companies to use lime for purification there was an objectionable smell emanating from gas-works which would reach half-a-mile. It was the use of lime which had given such works a bad name all over the country. Their Company spent about £10,000 in four successive applications to Parliament before they got relieved from this obligation; and when they did secure relief, the smell stopped. But the gas-works had got a bad name; and people living a mile away attributed every bad smell to them. He was not going to argue the subject; but at the Police Court the Company said it was a matter of absolute impossibility that the gentlemen who signed the memorial to the Council, and were the originators of the proceedings—and who lived, the nearest about half-a-mile from the works, and some a considerably greater distance away—could have smelt the gas-works. They did not deny that these gentlemen did experience a noxious smell; but the borough did not ventilate their sewers, except by open gratings in the middle of the roads, and this the Company said was the cause of the trouble. The Company were suffering for the ill-name of the past; but he had no doubt they would live it out.

The resolution was then carried.

The Dividend.

The Chairman then moved that a dividend for the half year ended June 30 be declared at the rates per annum of 5 per cent. on the preference stock and 5½ per cent. on the ordinary stock—less income-tax.

Mr. R. Wyllie, in seconding, referred, as a Workman-Director and an old servant of the Company, to the co-partnership scheme. He said the men took a greater interest in the work and welfare of the Company. They knew very well they were now to a large extent working for themselves as well as for the other shareholders; and they had the pleasure of knowing there was no fear of dispute arising between them and the Company, seeing that they were now co-partners in the undertaking.

The resolution was agreed to.

Extraordinary Meeting.

The meeting was then made extraordinary, for the purpose of considering an amended scheme enabling employees holding ordinary stock of the Company to elect Directors, pursuant to the provisions of the South Suburban Gas Act, 1904.

The Employee-Director Scheme.

The Chairman moved that the amended scheme be approved, and that the Directors be authorized to proceed with it, subject to such additions, alterations, and variations as the Board of Trade may think fit to make therein and the Directors approve. He explained that in 1904 the shareholders passed a scheme for the election of Employee Directors. There were to be only two then. The Act stated that when the amount of stock held by the employees exceeded £10,000, the Board might present a scheme for the election of Employee Directors. It did exceed this sum in 1904; and the scheme was presented and adopted. These Directors were to be either one workman and one officer or, if the officers did not choose to select one of their number, two workmen. The officers did not act under the scheme; and two workmen were elected. Mr. Waller, a bricklayer, was the first; and he was immediately followed by Mr. Wyllie, a carpenter. He was sure that the two best men in the Company's service had been selected for the purpose. He was proud to be able to say this, because it had been contended that workmen could not be trusted to make a wise choice. Mr. Thomas Burt, the highly respected Secretary of the Northumberland Miners' Union, and a Member of Parliament, said that when this responsibility was cast upon them, the workers might be trusted to select men who would be a credit to them; and the Company's employees had done this. Not only had Mr. Waller and Mr. Wyllie been very useful on the Board; but they had taken a proper view of their duties. Before the South Metropolitan Company got their Act authorizing the election of Workmen Directors, knowing the late Mr. Mundella's sympathy with workmen, he went and told him what the Company wanted to do. Mr. Mundella said he would like to see the experiment tried. But he was a little afraid that the men, if elected by workmen, might take a narrow view of their duties, and consider it was their place to look specially after the workmen's interests; and if they did, they would make a mistake, because when a man was once elected on the Board he should consider all interests. He (the Chairman) was pleased to say—and his colleagues would bear him out—that Mr. Waller and Mr. Wyllie had taken the view that, as Directors, it was their duty to do their best for the Company as a whole—for the three interests of consumers, shareholders, and employees. The South Metropolitan Company had had Employee Directors for nine years—first two workmen, and then two workmen and a clerk—and they did just as well as the South Suburban Company. They selected the best men possible; and when they retired (year by year in turn) they were always re-appointed. The South Suburban scheme lapsed this year, it having only been arranged for three years. The reason for this was that some people said if the scheme did not succeed there would be a strike if they attempted to get rid of it; so the Company fixed it in such a way that it would lapse absolutely at the end of three years, and if it was a failure there would be no more to say about it, and no renewal. The South Metropolitan scheme was arranged in this way; and they re-enacted it for nine years. The three years of the South Suburban Company expired this year; and the Directors proposed the re-enactment of the scheme, for a much longer term. They proposed that the scheme "shall continue in force until 1950, or short of that year so long as the shareholders approve." He thought by 1950 the system would be proved either a success or a failure. In other respects, the scheme was mainly a repetition of the old one; but there was a little variation. For instance, they wanted to provide for the increasing holding on the part of the employees. They had now £20,000 in ordinary stock of the Company, whereas they had £10,000 when the scheme was started; and if the system was to be a success, their holding must go on increasing. Suppose in three or four years the employees' holding got up to £30,000, and that then a change should come over them and they should say they had no longer confidence in the Company, and should sell their stock, and the £30,000 should become reduced to (say) £25,000, were they still to have the same representation on the Board? Of course, the principle of this representation was that it should be a representation of property held by them in the Company. The scheme was not merely a partnership in profits, but it was a partnership in responsibility; and that might be a more important matter. Therefore the Directors made a provision that if at any time the aggregate investment of the employees should fall back by 10 per cent. of its amount below any figure it might have attained, one of the Employee Directors should retire, and the number should be reduced to two. If the reduction amounted to 20 per cent., the number should be reduced to one; and if a reduction of 30 per cent. took place, this should disqualify the remaining Director. These conditions did not apply when the aggregate holding of the employees exceeded a tenth part of the capital, or more than £60,000. This was to maintain the principle that the representation was a representation of property, based on confidence in the Company. Then there was another proviso, because it would be very awkward to saddle the Company with a thing of this kind absolutely, which, in the event of failure, might turn out rather disastrous. It was therefore provided that the scheme shall continue in force so long as, in the opinion of the shareholders, it answers its purpose of promoting a true union of employers and employed. If the employee shareholders should reduce their holding of stock below the 30 per cent. mentioned, the scheme should thereby become null and void, and incapable of revival, until the conditions under which the Employee Directors were sitting were restored. Should this happen, the Directors, with the shareholders' consent and approval, might revive the scheme. In the event, in the opinion of the Directors, of the failure of the scheme to answer the above-named purpose, it could be terminated by a special general meeting of shareholders—the whole procedure and the termination of the scheme to be subject to the consent and approval of the Board of Trade. This was to provide for possibilities; the Board did not think they were probabilities. They regarded it as almost out of the range of probability that the thing could fail; but if Socialism should become the dominating principle animating the people of the nation, he supposed there would be an end to this scheme and most others. The fees of the Employee Directors would start at 21s. According to the Act, the fees should bear some proportion to the amount of the qualification—not being less than an ordinary day's pay nor more than four times that amount. As the aggregate holding of stock increased, the qualification of the Employee Director increased. With £20,000 of stock held, the qualification was £100; with £30,000, £120; with £50,000, £140; and with an aggregate holding of one-tenth of the total capital, the qualification was £150. No man was eligible for an Employee Director unless he had been continuously for fourteen years in the employ of the Company, and he had held for not less than twelve months prior to the date of election, and continued to hold, not less than £100 in the stock of the Company. He thought

they had inserted all safeguards, and that the shareholders might be content to pass the scheme. It was a great experiment; and they might take credit for trying to do something for the good of the nation, and something which, if it were adopted generally by joint-stock companies, would, he believed, lead to a much more satisfactory position as regarded Capital and Labour. It had been left to these two or three Gas Companies to show the way. The shareholders of the South Suburban Company had always been perfectly willing to help in this matter, and he hoped they would be so still.

The DEPUTY-CHAIRMAN seconded the resolution; and it was carried unanimously.

On the proposition of Mr. BORASTON, seconded by Mr. G. READ CLARKE, a vote of thanks was passed to the Board and officials.

Of this, acknowledgment was made by the CHAIRMAN, Mr. S. Y. SHOUBRIDGE, the Engineer, and Mr. CHAS. M. OHREN, the Secretary. Mr. Shoubridge remarked that he thought he could promise that the results of the present half year would be equal to, if not better than, those of the past.

CROYDON GAS COMPANY.

Flourishing Business—Works Changes and Improvements—The Coal Market.

The Half-Yearly Meeting of this Company was held on Friday, at the Offices, Katharine Street, Croydon—Mr. CHARLES HUSSEY, J.P., in the chair.

The SECRETARY (Mr. W. W. Topley) read the notice calling the meeting, and it was agreed to take as read the Directors' report and the accounts.

The CHAIRMAN, in moving their adoption, said the statement of accounts which he had the pleasure to submit was one which would, he thought, be gratifying to the proprietors. In all directions, it bore evidence of a growth in the undertaking which was steady and continuous, though not sensational, but perhaps the more satisfactory on that account. It would have been noticed that the increase in the sales of gas amounted to 8·27 per cent. on that of a year ago. This represented in quantity an increase of more than 44 million cubic feet, and in value nearly £6000. Residuals had also yielded an increase of £3300; making a total increase on the credit side of the revenue account of nearly £10,000. The raw materials—coal and oil—had cost £7000 more; and the difference of about £3000 was more than represented by increased gross profit; this being £3400 more than a year ago. From the profits thus at their disposal, the Directors had placed a further £1000 to the renewal fund; and they proposed to carry forward, after the payment of dividends, a balance of £7487, or £3000 more than last half year. It would be seen from the report that the increase in the number of consumers was 929; bringing the total to just over 30,000. The stoves on hire continued to increase, not only in number, but in proportion to the number of consumers. He had in past half years pointed out that the Company did not supply stoves as part of prepayment installations without charging a specific rent for their use; and so they were entitled to assume that every stove out on hire was required, and was used, by the consumer hiring it. After a brief reference to the lecture delivered at the new offices and show-rooms, by Professor Vivian B. Lewes on May 29 (as reported in the "JOURNAL" at the time), the Chairman said, in connection with the show-rooms—of which the Company now had four to meet the convenience of consumers in their widely scattered district—that the proprietors might not be aware that the authorized area of supply now covered some 70 square miles. The Directors had arranged that on four days in each week the show-rooms should remain open till seven o'clock in the evening. This would, they hoped, meet the convenience of that large section of the consumers whose business engagements prevented them from reaching the offices by the usual closing hour. There had now been a full half-year's experience of the working of the large range of new stove-repairing shops at the works, and the Directors had every reason to be satisfied with the result. The Company had gained greatly in the quality of the work turned out there, and in the promptness with which it was executed. It was also found that they could effect very considerable savings as compared with the cost of working under the former less advantageous conditions. As most of the proprietors were probably aware, the Company had, since the acquisition in 1905 of the Caterham Company's undertaking, carried on the manufacture of gas at that Company's comparatively small works at Whyteleafe, as well as at Waddon. It was from the first intended that as soon as possible, all the manufacture should be carried on at the Waddon works, and a saving be thus effected from the more economical methods possible there. The margin of manufacturing plant at Waddon over the Croydon needs had, however, until now been so narrow that the Directors had not felt justified in throwing on the Waddon works the extra burden. But as the new section of scrubbing, washing, and purifying plant at Waddon could be brought into use for the coming winter, it had now become possible to close the Whyteleafe works; and they were accordingly closed last April. They might look for some saving from this step; and the Board had hopes of letting such portion of the old works as they did not need for distribution purposes, and of obtaining a small further revenue from this source. Regarding the reference to the new section of scrubbing, washing, and purifying plant at Waddon, at the last two or three half-yearly meetings, he had told the proprietors of the steps the Board had been taking in this direction. This portion of the old plant was practically the same as that of thirty years ago, when only one-fifth of the present output of coal gas had to be dealt with; and it was not only becoming inadequate to the work it had to do, but was of an old type. He need hardly point out to those of the proprietors who kept in touch with the trend of gas engineering that great—he might almost say revolutionary—changes and improvements had come about of late years. The plant their Engineer had just completed embodied the latest and most improved methods. It had just been tested with satisfactory results, and was now coming into use; and they looked to it to effect improvements in their working results. There was much now at the works worth seeing by anyone taking an intelligent interest in modern processes of gas manufacture; and the Directors hoped, at a comparatively early date, to invite the proprietors to visit the works, and inspect their property, of which he ventured to assert they would feel as proud as did the Directors. It would have been seen from the report that the price of gas in the district supplied up to 1894 by the Carshalton Gas Company was now, by reason of an arrangement embodied in the Croydon Company's Act of 1904, reduced to the price in Croydon—at the present time, 2s. 8d. per 1000 cubic feet. The result of this reduction in the price of gas in Carshalton was that the holders of the "Carshalton" capital—that was to say of the "C" stock—would from this half year receive a dividend at the same rate as that upon the "B" stock. Their dividend would rise from 10¾ to 11½ per cent. per annum. It might be of interest if he mentioned that, as a result of the amalgamation of 1894, the Carshalton consumers, who were formerly paying 4s. 6d. for gas, and receiving a dividend of 8 per cent., would now pay 2s. 8d., and receive a dividend of 11½ per cent. So far, he had dealt chiefly with the past. As to the future, the two topics of most absorbing interest from the point of view of gas administration were, of course, the price of coal and the price of gas. The contracts for coal for the year to June next were now made; and an increase in cost, due to the higher prices, would have to be faced of some £12,000 in the coming year. Gas companies could generally look for an improvement in the yield from some of their residuals as a partial set-off against increases of this kind. It must be borne in mind, however, that, while during this past year they had been getting coal at prices based on those ruling in the early part of 1906 (when their last year's contracts were made), they had during last winter been getting for coke the high prices due to the general advance in fuel. It would not therefore be wise to be too sanguine in their anticipations as to residuals, though they might, be thought, look for some little advantage in this direction. Perhaps they might venture to estimate the increased net cost of raw material during the whole of the coming year at about 2d. per 1000 cubic feet of gas made. They had over and above this to provide for the charges on revenue which would have to be met in respect of the alterations and improvements of the old retort-houses, on which work a commencement had been made; and they would further have to face the loss of revenue from the reduction of price in Carshalton and the increased dividend on the Carshalton capital. These last two items represented about £2700 per annum. In large measure, the sum they were about to spend on alterations would result in an improved capital value, and to that extent they might rightly charge them to capital. But sound finance required that such part of their coming expenditure as represented renewals should be borne by revenue. As he had said, the renewal fund (which they had been forming since their Act of 1904, and which now amounted to £5167) was available, and had been, in fact, created for this purpose. But it was not at present sufficient to fully meet these charges; and they had to be met in some way. The four items of expense named—dear coal, and heavy renewal charges, with the reduction in price and increased dividend on the Carshalton capital—falling together, caused the Directors some apprehension as to whether some small increase in the price of gas might not shortly become necessary. He could only say at this stage that it would be with the greatest possible reluctance that the Directors would adopt such a measure, and that, in the event of an advance being found to be unavoidable, every effort would be made to reduce the price again at the earliest possible date. At the time of the last coal boom (in 1900), the Directors refrained from advancing the price of gas till long after it had in most other districts gone up from 3d. to 7d. per 1000 cubic feet; and the small advance which they did at last make was continued for only a short time. It would be their endeavour to maintain now a similarly good position for the Company.

The DEPUTY-CHAIRMAN (Mr. Thomas Rigby) seconded the motion, which, after two or three inquiries regarding the accounts had been answered, was unanimously agreed to.

Mr. CORBET WOODALL proposed the declaration of a dividend at the rates per annum of 14½ per cent. on the "A" stock, 11½ per cent. on the "B" stock, 10¾ per cent. on the "C" stock, 5 per cent. on the "D" capital, and 10 per cent. on the "E" capital—all less income-tax. It was, he said, a great pleasure to propose a dividend so satisfactory as they were doing that day. This was a time of abounding prosperity in the country; and yet one heard all round moans from the managements of industrial undertakings about falling values and reducing profits. Many of the industries were essential to the comfort, if not to the life, of the nation; and yet they felt the stress of competition and all other circumstances tending to the reduction of value more keenly than the gas industry (which was sometimes spoken of as a "decaying industry") had done. The number of applications open to gas, and the great number and variation of the products obtained in the distillation of coal, were such that they usually found when one was depressed some other was in good trim or booming; and so the even tenour of their way was little disturbed. The Chairman had referred to the extraordinary circumstances under which gas undertakings were passing just now, with the vast increase in the price of coal. Coal had cost them a higher price during the past half year than in the corresponding half of 1906. It would cost them a very much larger sum in the year upon which they had just entered; but they had heard the Chairman's hope, and he (Mr. Woodall) might express his own confident expectation, that they would "worry through" the year without any necessity for an increase in the price of gas. Consequently those of their neighbours and friends who were users of gas-fires and gas for other purposes would feel no inconvenience from the great increase which the Company would have to meet in the price of coal. With regard to the works themselves, as the proprietors knew, a very large sum of money had been spent upon them—evidenced by the steadily increasing amount of the capital expenditure; but they had works which were steadily increasing in their economic efficiency, and of which, he felt sure, the proprietors would be proud when they visited them, and which they knew would do all that good works under the direction of a good Engineer could accomplish for them. He (Mr. Woodall) looked forward with as much cheerfulness to the future, and with as much confidence, as he had done in the past.

Mr. WILLIAM CASH, in seconding the motion, remarked that, after paying the dividend, there would be the satisfactory balance of £7487 to be carried forward.

The motion was unanimously carried.

The usual votes of thanks were passed to the Chairman and Directors, to the General Manager and Engineer (Mr. J. W. Helps), the Secretary (Mr. W. W. Topley), the Assistant Engineer (Mr. A. C. Caddick), the Distribution Superintendent (Mr. W. J. Sandeman), the staff, and the workmen. The remarks of proposers and seconders were most appreciative, and the proprietors' endorsement equally cordial.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Annual General Meeting of the Company was held last Saturday, at the Works, Willoughby Lane, Tottenham—Mr. Corbet Woodall in the chair.

The Secretary (Mr. E. Topley) read the notice calling the meeting; and it was agreed to take as read the Directors' report and the accounts for the half year to June 30.

The Chairman, in moving the adoption of the report and accounts, said it was his pleasant duty once more to submit a good report on the affairs of the Company. If, at the conclusion of the meeting, the proprietors would walk round the works, they would, he was sure, see evidence that the year since they last met there had not been an idle one. With one slight exception, all the extensions which were in hand a year ago were now completed, and paid for. The Company would now have a respite from new construction; but if increases of 10 per cent. per annum were still in store for them, the respite would be but a short one. The new plant had not only enabled them to meet the necessities of the consumers, but it had proved economical in wc1king, and had enabled them, in face of the trying circumstance of a heavy additional cost for materials, to reduce the price of gas.

CAPITAL AND CONSUMPTION INCREASES—REDUCTION OF CAPITAL PER MILLION CUBIC FEET.

A visit to the works naturally suggested retrospect; and he had had prepared a few figures illustrating the progress of the Company during the last four decades. He found that in 1866 the total capital employed was £56,146; by 1876, it had increased to £75,000, or 33·6 per cent. in the decade. In the same period, the quantity of gas delivered increased by 142 per cent. In the following decade, the capital advanced to £147,819, or 98 per cent.; while the increase in the quantity of gas distributed was 131 per cent. By 1896, the capital was £239,457, or an increase in the decade of 62 per cent.; and the increase in the quantity of gas delivered was 70·3 per cent. By June last, the capital was £563,249, or an increase in the decade of 135 per cent.; while the increased quantity of gas sent out was 214 per cent. The effect of this was shown in the proportion of capital employed per million cubic feet of gas sold. In 1866, £1377 was employed for the manufacture and distribution of each million cubic feet of gas. In 1876, the £1377 had fallen to £759; after the lapse of another ten years, it was £646; in the following ten years, it fell to £614; and at the present time, it was £461 per million. The effect of this was seen in the amount of money required to pay the dividend and interest. In 1866, for every 1000 cubic feet of gas sold, to pay the dividend and interest 2s. 0·44d. was required; the dividend at that time being 9 per cent., and the interest 5 per cent. He would not trouble the proprietors with the figures for the intervening period; but to-day they paid the dividend on the stock and the interest on the borrowed money with 6·39d.—less than 6½d., against 2s. 0·44d. in 1866. This was not because there had been a reduction in the amount of the dividend, inasmuch as in 1866 the dividend was 9 per cent. and the interest 5 per cent., and now the dividend was 13½ per cent. and 10½ per cent. (interest being 4 per cent.)—that was to say, the dividend after allowing for the conversion of the stock, which took place a few years ago. He thought these figures were not only striking, but remarkably satisfactory. It had been a period of unbroken advance in the direction of reducing the cost of manufacture, and vastly increasing the amount of gas sold, and at the same time increasing the dividends of the proprietors. The increase of the dividends had always been accompanied by a reduction in price. In 1866, the price of gas was 5s. per 1000 cubic feet; in 1876, 4s. 3d.; in 1886, 3s. 4d.; in 1896, 3s.; and in 1907, 2s. 6d. So that, taking the figures as one would, they showed progress in the direction that the Directors, and he was quite sure the proprietors, desired that progress should be made. And he might say that he saw nothing whatever in the outlook to cause fear that the rate of progress in the right direction would not be continued. It was true they were now faced with competition. The public supply of electricity was introduced into Edmonton about three months ago. He had said before at their meetings that, in his opinion, there was room for both services, and that they could, without disloyalty to gas, wish prosperity to the younger aspirant for favour. In the Company's area especially, gas with its many useful applications was more essential than electricity; and they were accordingly the stronger. The Company would not, however, part with any fraction of their supply till they had exhausted all means to retain it.

PROGRESS OF THE TOTTENHAM AND EDMONTON GAS COMPANY.

Table from which the Chairman, Mr. Corbet Woodall, quoted at the Meeting of the Company last Saturday.

Year.	Capital Employed.				Gas Sold.		Revenue.		Price per 1000.	Dividend and Interest Paid.	Per 1000 Sold.
	Total. £	Increase. £	Per Million. £	Decrease. Per Cent.	Thousands.	Increase.	Total. £	Increase. £	s. d.	Per Ce t.	s. d.
1866 . .	56,146	—	1377	—	40,760	—	12,465	—	5 0	Div. 9 Int. 5	2 0·44
1876 . .	75,000	18,854 or 33·6 %	759	81·4	98,802	58,042 or 142 %	28,379	15,914 or 128 %	4 3	Div. 10 Int. 5	1 4·38
1886 . .	147,819	72,819 or 98 %	646	17·5	228,658	129,856 or 131 %	47,843	19,464 or 61 %	3 4	Div. "A" 11, "B" 8 Int. 4	1 0·53
1896 . .	239,457	91,638 or 62 %	614	5·2	389,523	160,865 or 70·3 %	67,232	19,389 or 40 %	3 0	Div. "A" 11½, "B" 8½ Int. 4	d. 10·60
June, 1907	563,249	323,792 or 135 %	461	33·2	1,220,560	831,037 or 214 %	209,362	142,130 or 211 %	2 8 and 2 6	After Conversion. Div. "A" 6⅝, "B" 5⅛ Int. 4	d. 6·39

A REVIEW OF THE HALF YEAR'S ACCOUNTS.

Turning now to the accounts. The working results of the half year had been very good. They had sold more than 11,000 cubic feet of gas per ton of coal, or oil equivalent to 1 ton of coal, used. Materials had cost £3000 more; but the gas sold was worth £7500 at last year's price, and the reduction in charge gave back over £5000 of this to the consumers. The increased quantity of gas made had involved no addition to the wages bill. The receipts for products were £5300 more, due partly to the larger quantity of coal used, and partly to the circumstance that they were reaping advantage from the higher price of coke, while still purchasing coal at the rates of last year. The result of the trading was that, after paying all charges for interest, they had a balance £2000 in excess of what was needed for dividend at last year's rate. This being so, the Directors recommended the payment of ⅛ per cent. per annum more on each stock, which was the amount to which the proprietors were entitled by reason of the reduction in the price of gas. This would absorb £648. Further, the Directors had written down the value of Consols, in which the reserve and insurance fund were partly invested, to 85 per cent. at a cost of £963. They had also paid £1245 for stamp duty on the new capital created, and £469 for redemption of tithe and land tax on the new land purchased. These sums together amounted to £3467, and reduced the balance carried forward by £1510. The reserves amounted to £50,000.

THE COAL AND COKE SITUATION.

The Directors had made contracts for coal to July next at an average increase per ton of 2s. 6d. This meant a total sum of £10,000 for the twelve months. They were selling coke at an enhanced price; so that a large portion of the £10,000 would be a clear inroad upon profits, and must be provided for as best they could. One thing was quite certain, they would not meet the deficiency by increasing the charge for gas. The consumers might rest assured that, unless the very much unexpected happened, the tendency of the price of gas would be downward rather than upward. The experience of the past half year had deepened the regret he had expressed at the removal of the duty upon exported coal. It was possible that the duty, if continued, might not, under the peculiar circumstances of the time, have materially reduced the quantity exported, but they would have had the satisfaction of seeing the exchequer benefited, and the occasion for heavy taxes reduced as some compensation for the great inroads upon our national reserve of power. If coal continued at the present heavy cost, it would, of course, impose great hardships on the poor, both directly by adding to the cost of domestic fuel and indirectly by crippling the industries which provided employment. Though the Directors would not increase the cost of gas, neither would they be able to reduce it, and their charge for coke would be heavier.

CARBURETTED WATER GAS.

The oil-gas plant was in good order, and was being used freely, so as to keep down the quantity of coal carbonized. There was some difficulty at first in disposing of the tar made under this process. But its value had now been established; and they were receiving a larger price for it than for the tar from coal.

GOOD PROSPECTS.

The longer he was associated with the gas industry, the more impressed was he with the broadness of the foundation on which it was based, and the area of the field yet to be cultivated. One development showed the way to another; and whether in the processes of manufacture, or in the application of the gas when made, they had by no means exhausted the possibilities before the industry. Most shareholders who had held gas stock steadily were to be congratulated. It had been a good investment in the past; and, in his opinion, never stood better than at the present time. Holding these views, he had no hesitation, but great pleasure, in moving the adoption of the report and statement of accounts.

Mr. Henry Bailey seconded the motion, which was unanimously adopted.

The Increase in Dividend.

The Deputy-Chairman (Mr. D. Ford Goddard, M.P.), moved the declaration of dividends at the rates per annum of 6¾ per cent. on the "A" stock and 5¼ per cent. on the "B" stock. In the course of his

remarks, he said that, arising from a misconception of the facts, there were certain people who seemed to think that those who took dividends from industrial concerns were all rich people, of the class of millionaires. As a matter of fact, the people who took dividends out of gas companies were not of that community at all, but they were people who were thrifty, and who had taken care of their earnings and savings, and who put them by in what they considered to be good sound industrial undertakings. These people had every right to the profits which the undertakings realized in which they invested their money. The resolution he had to move on this occasion was an additionally pleasant one, because it suggested the payment of an extra ¼ per cent. The profit had been fairly earned. And he should like to point this out: That for every £1 the proprietors received by way of profit in addition to the standard rate of dividend, they had to give to the consumers £8. That was the proportion that existed—1 to 8. The figures the Chairman had given them that day as to the progress of the Company were most amazing; and should be studiously considered. They meant a tremendous deal. In face of a strong competition like the electric light, they were holding their own and improving their position; and the striking facts showed the wonderful character of the district. The district was what he might call the dumping-ground for the excess population of the congested areas of the great Metropolis; and the Company were reaping the benefit.

Mr. G. T. Watson seconded the motion; and it was unanimously agreed to.

Moved by the Chairman, and seconded by Mr. W. B. Randall, Mr. Henry Bailey was re-elected a Director; and on the proposition of the Chairman, seconded by Mr. J. L. Chapman, Mr. Watson was also returned to his seat at the Board.

Mr. J. Eve proposed, and Mr. E. Sawyer seconded, the reappointment of Mr. Edward Crowne as one of the Auditors; and the proposition was passed.

Dr. Scott moved, and Mr. J. Grounds seconded, a vote of thanks to the Chairman and Directors for the valuable services they had rendered to the Company.

The Chairman responded, and then moved a vote of thanks to the officers, staff, and workmen of the Company; remarking upon the interest in, and devotion to, the work exhibited by one and all.

Testimony as to the Value of Technical Directors.

Mr. A. E. Broadberry thanked the Chairman, Directors, and proprietors, on behalf of himself, his staff, and the workmen, for the vote. Naturally, he remarked, with all the work that had been going on, they had had a great deal to do; but they enjoyed doing it. The quantity of work that had been proceeding could be imagined by the proprietors as they inspected the buildings and plant. This had not been done at the expense of a high price for gas, because, as the Chairman had shown, the charge for gas was very low for an outside London area; it had not been done at the expense of the proprietors, because they were receiving larger dividends than they had ever had before; and the capital account had been very materially reduced per million cubic feet of gas sold until it had reached a very low figure. At previous meetings, this work had been referred to; and his staff and himself had had a great deal of praise for it. But there was one thing he should like to place on record. He had done it at technical meetings; but he should like to do it also at this one. It was this, that these beneficial results, in his opinion, had been brought about more by the fact that the Company had a highly Technical Board than by anything else. They had a Chairman who was an eminent engineer; they had a Deputy-Chairman, who was also a gas engineer by profession, and had done a great deal of service for the gas industry; and the last addition to the Board—Mr. James Randall—was almost a gas engineer from his long experience in the gas industry. It could be readily imagined that, with such a Board as this, all the officers had to keep themselves absolutely up to "concert-pitch" in their knowledge as to what was proceeding in the gas industry; and they had to have very good reason for the faith that was in them when they brought any recommendation before the Board, because any flaws would at once be seen, and the recommendations would not be accepted. But there was something beyond that. Although some gas engineers did not like a technical board, he could assure them that such technical engineers as they had on the Tottenham Board were a great help in carrying out the work. When he had brought proposals before the Board, the technical assistance and encouragement he had had from Mr. Woodall and Mr. Goddard had enabled him to make the works what they were. The works, he said emphatically, could not have been what they were but for the fact of the Technical Board. When the proprietors went round the works, they would realize that they were second to none in the country in efficiency and cleanliness. So long as they were allowed to continue, it would be the aim of all connected with the work of the Company to keep gas the leading illuminant of the day.

Mr. Topley also briefly responded; and the proceedings terminated.

The proprietors afterwards inspected the works, under the guidance of the Engineer and his assistant (Mr. J. Terrace); the Chairman and Directors also accompanying.

WEST HAM GAS COMPANY.

Development of Business and Capital Requirements—The Coal Market and the Price of Gas.

The Half-Yearly General Meeting of the Company was held last Wednesday, at the Liverpool Street Hotel, E.C.—Mr. J. Lister Godlee in the chair.

The Secretary (Mr. A. G. Snelgrove) read the notice calling the meeting; and the Directors' report and the statement of accounts were taken as read.

The Chairman, in moving the adoption of the report and accounts, said, in considering the latter, the shareholders would bear in mind that throughout the half year the price charged for gas had been 1d. per 1000 cubic feet less than in the corresponding half of 1906. But for this, the sum received for gas would have been £3476 higher than it was. Regarding the increase of more than £3000 in rates and taxes, the Directors had been discussing for about three years a proposal to raise the Company's assessment, which appeared to them to be excessive. They had arrived at last at a settlement, which their advisers had recommended them to agree to; but the reduction of the proposed assessment was not so great as the Board had hoped. They had no doubt been a little too sanguine; and while making provision in their accounts from time to time to meet some increase in the assessment, they had not made enough; and the balance had to be paid out of this half year's income. The amount of the item therefore appeared abnormally large; but, as a matter of fact, the rate in the pound this year was somewhat less than it was last year. Notwithstanding these large figures, the half-year's results were eminently satisfactory. There had been a small further decrease in the carbonizing wages, while the total charges for manufacture were nearly 1d. per 1000 cubic feet less than last year. The distribution charges showed an increase per 1000 cubic feet of gas sold, which was to be accounted for by the continued rapid increase in the consumers using slot meters, and to the amount the Directors continued to write off for the depreciation of the meters and fittings. In the result, the net profit for the half year was just ¾d. per 1000 cubic feet sold less than in 1906, while the price of gas had been 1d. less. The fixed capital had come down from 12s. 5d. at the end of the year 1906 to 12s. 1d. per 1000 cubic feet of gas. The quantity of gas made during the half year (860 million cubic feet) was nearly 94 million cubic feet more than in the first half of 1906—an increase of 12·25 per cent.; while the quantity sold was 834 million cubic feet, or an increase of 12·8 per cent. Up to the present time, in the current half year, they were making a still greater increase over the corresponding months of 1906. If this rate of increase were maintained, it meant that they would have to make provision for the manufacture of an additional 240 million cubic feet per annum. This would go far to explain the necessity for the extraordinary meeting which was to follow this one. As he believed he told the shareholders in February, the running coal contracts, most of them made two years ago, had saved the Company from being seriously affected by the startling rise in the price of coal, and they had not seen any reason up to now to announce an increase in the price of gas. But he was not at all prepared to say that they might not be obliged to do so before long. They had made fresh contracts on terms that, under the circumstances, the Board thought satisfactory; but the increased cost of coal during the next twelve months would be about £16,000. Of course, the Directors anticipated that this sum would be to some extent provided for by additional income from residual products; but it was impossible at the present time to say how much this would be. It was, however, a very large amount for the Company to have to meet out of profits; and although they would have £19,600 of undivided profits standing to the net revenue account, after paying the dividend and making the addition to the reserve fund which the Board recommended, yet, unless they saw a prospect before long of a material reduction in the price of coal (and they had no good reason to expect it in the immediate future), he was afraid they would have to take the same course as many of their neighbours had been obliged to adopt. It would have been noticed in the report that the Directors suggested that the same dividend should be paid on the ordinary stock as was declared last year, and that the additional 1s. 3d. per cent.—viz., £528—which the reduced price of gas enabled them to dispose of should be carried to the reserve fund. This proposal was in accordance with suggestions he had more than once made at the meetings, that the time was coming when they ought to increase the fund, which now amounted to £13,222. The Directors considered it was very advisable that the fund, which had been found of great use not so very long ago, should be enlarged more rapidly than by the automatic increase coming from investing the dividends received from the India Stock in which the fund was placed. He hoped the proprietors would agree in thinking that it was wise to strengthen the Company's position in this way. The present was, as it seemed to him, a very suitable occasion for doing this. It was more satisfactory to pay a steady dividend than to make a small increase in it, and then in a very short time perhaps to be compelled to reduce it again. The remarks he had made to the shareholders had some weight in this matter. If they paid the same dividend of £5 2s. 6d. now, they would not be under the necessity of making any alteration in it in the event of their being obliged to raise the price of gas, unless it was found essential to add more than 1d. per 1000 cubic feet to the price. The shareholders would allow him to add a few words at once on the proposals to be brought before them at the extraordinary meeting, so that he might deal with the whole position of the Company in one speech. It would be seen that the balance on capital account at the end of the past half year was £28,610; while during the half year their expenditure properly chargeable to capital, after deducting the large depreciation charged to revenue, amounted to more than £40,000. He had already stated that the business went on expanding very rapidly. This was especially marked in the slot-meter business, which showed no signs yet of falling off; and it was, in fact, impossible to meet the demands made upon the Company, except by capital expenditure. He did not know that this expenditure would be quite so heavy during the present half year; but it would be very considerable, and it was quite certain they would soon want more money than the amount standing to their credit on this account. The shareholders would not wish the Directors to be continually coming for fresh authority to issue capital; and they had always been willing to entrust them with large powers, leaving the time of exercising them to the discretion of the Board. He did not at present think they would raise any additional capital before the end of the year; but it would probably be necessary to begin negotiations before the shareholders met again. The Directors therefore asked them to create a further sum of £75,000 partly of preference and partly of consolidated stock, and £35,000 of debenture stock. The possession of this power was an assistance in case the Board required some help from their bankers; but they would not issue more of any of these stocks than they thought the occasion demanded. If the shareholders adopted the resolution which would be submitted at the extraordinary meeting, the power of creating capital given in the Company's last Act of Parliament

would be limited to a further sum of about £59,000 in preference and ordinary stock, and a sum of £46,700 in debentures. It would no doubt occur to shareholders that this meant that the Company would be obliged to be in Parliament again in the session of 1909 or 1910—probably the former. That was only seven or eight years after their last Bill, which their opponents suggested provided them with enough money for twenty years. He hoped the suggestion of the Directors would be approved. It would be seen in the report that the Bill which had been promoted by the Company and several others for relieving them from certain statutory restrictions on account of sulphur compounds in gas had been passed; it was, in fact, unopposed in all its stages. They were by this Act placed in the same position in this respect as their larger neighbours. The parliamentary costs falling upon the Company for the Act only came to some £192. He wished they could do parliamentary work as cheaply as this on all occasions. In conclusion, he said the Company were still in a very prosperous condition, and that if there was one black rock looming ahead, they did not think there was any risk of their being shipwrecked upon it, or suffering any disaster therefrom. The results of the working were the best evidence that the shareholders were still well served by their excellent staff, many of whom were now old servants.

Mr. T. S. GEERE seconded the motion, remarking that he hoped the shareholders would be well satisfied. The Company were making great strides; and these were being maintained.

Mr. CLEVERLY remarked that it might be a little ungracious to ask any questions after the excellent exposition they had had as to the Company's finance. There were, however, two or three little points upon which he should like information. With regard to depreciation, had there been sufficient put by under this head? As to the sulphur compounds question, were the Directors quite satisfied as to this matter? He (Mr. Cleverly) did not say it was wrong, but he had a little nervousness as to whether the sulphur would not be rather a drawback to them some of these days. Respecting the investment of the reserve fund, India Stock had depreciated; and he should like to know whether sufficient had been written off for that. As to the slot-meter installations, he took it a large portion of the capital required would be used for the purposes of slot installations. Could the Chairman give them the average price of the installations during the past half year? It seemed to be quite unnecessary, or it ought to be quite unnecessary, to impress upon the Directors that this was a time to be very economical in the expenditure of capital.

The CHAIRMAN, in reply, said he thought the Directors were putting by enough for depreciation. The only question that had occurred to some of them was as to whether for some parts of their works they were not writing off rather too much. But it was the most wholesome thing they could do to write off somewhat severely for depreciation; and he did not think they were doing too little. He was quite satisfied with having obtained the power, by their new Act of Parliament, to leave the sulphur compounds other than sulphuretted hydrogen in the gas. It did not oblige them to leave in too much sulphur. They were not compelled to sell bad gas because they could do it without being caught; and the shareholders might leave the Directors and their officials to look after this. As to the writing-down of India Stock, it would be hopeless to keep writing it up and down; and such a course would not help them in any way. As to the cost of the slot installations, at the present time it ran out at about £7 each.

On the proposition of the CHAIRMAN, seconded by Mr. H. C. PELLY, a dividend was declared at the rate per annum of 5 per cent. on the preference stock and £5 2s. 6d. per cent. on the consolidated ordinary stock.

Extraordinary Meeting.

An Extraordinary Meeting was then held, at which the CHAIRMAN moved a resolution, authorizing the Board to create and raise as required £25,000 of preference stock, £50,000 of consolidated ordinary stock, and £35,000 4 per cent. perpetual debenture stock. In his remarks, the Chairman gave a *résumé* of the statement he made in his opening speech.

The resolution was seconded by Mr. FRED. NICHOLSON; and carried unanimously.

On the proposition of Mr. WIGLEY, seconded by the Rev. T. TEED-HEAVER, the services of the Board were heartily acknowledged; and, in his response, the CHAIRMAN made generous allusion to the work of the chief officials, their staffs, and the employees.

COMMERCIAL GAS COMPANY.

The Half-Yearly Report and Accounts.

The following is the report the Directors of the Company will present at the half-yearly meeting on Thursday.

The revenue account shows a net profit for the half year of £61,8c6 11s. 10d., which, added to the balance of £22,947 5s. 8d. brought forward from last year, produces a net revenue balance of £84,753 17s. 6d. Deducting therefrom £9725 2s. 6d. for interest, there remains standing to the credit of the net revenue account a balance of £75,028 15s. available for dividend. The Directors recommend the payment of dividends thereout at the rates of £5 4s. per cent. per annum upon the 4 per cent. stock of the Company, and of £5 per cent. per annum upon the 3½ per cent. stock, both less income-tax. The balance of the net revenue will be carried forward to the next half year. The Directors announce with much regret the death of their esteemed colleague Mr. Thomas Bevan, who was for eighteen years a Director of the Company.

The accounts accompanying the report consist of the usual statements. They show that the paid-up stock on the 30th of June amounted to £937,605; that £1,076,875 had been added by conversion, making £2,014,480; and that £210,776 remained unissued out of the total authorized (including premiums) of £2,235,000. The total amount borrowed on the above-named date was £339,062 10s., and £135,937 10s. was added by conversion; making a total of £475,000, and leaving £79,226 to be borrowed out of the £550,000 authorized. The receipts on capital account amount, with premiums, to £2,544,586 16s. 5d. The expenditure stands at £1,396,884 3s. 9d., with a nominal amount of £1,212,812 10s. added by conversion—together, £2,609,696 13s. 9d. There is consequently a balance of £65,109 17s. 4d. carried to the balance-sheet. The expenditure on capital account in the half year was £11,639, apportioned as follows: New and additional mains, services, &c., £2726; stoves, £3252; prepayment meters and fittings (less £6944 written off for depreciation), £5661. The reserve fund amounted to £34,134; and the insurance fund to £32,647. The following is the revenue account:—

Expenditure.

Manufacture of gas—		
Coal and oil, including dues, carriage, unloading, and trimming	£96,227 5 2	
Salaries of Engineer and officers at works	2,398 19 8	
Wages (carbonizing)	18,369 15 6	
Purification, including labour	1,682 13 3	
Repair and maintenance of works and plant, materials and labour, less £560 1s. 2d. received for old materials	22,501 14 7	
		£141,180 8 2
Profit sharing		2,895 8 8
Distribution of gas—		
Salaries and wages of officers and rental clerks	£3,902 19 7	
Repair, maintenance, and renewal of mains and services, material and labour	8,363 14 2	
Repair and renewal of meters	2,721 3 2	
,, ,, ,, ,, stoves	6,865 14 10	
,, ,, ,, ,, prepayment meters and fittings	8,446 11 5	
Incandescent mantle maintenance, &c.	499 11 4	
		30,099 14 6
Public lamps—lighting and repairing		2,514 12 4
Rent, rates, and taxes		12,601 15 8
Management—		
Directors' allowance	£1,250 0 0	
Company's Auditors	75 0 0	
Salaries of Secretary, Accountant, and clerks	1,222 4 6	
Collectors' salaries and commission	1,725 18 5	
Prepayment meter collection	2,203 3 9	
Stationery and printing	1,120 16 2	
General charges	1,910 3 11	
		9,507 6 9
Bad debts		1,027 15 6
Law and parliamentary charges		186 5 5
Superannuations and allowances		1,259 12 10
Official officers, &c.		101 15 10
Total expenditure		£201,375 15 8
Balance carried to net revenue account		61,806 11 10
		£263,182 7 6

Receipts.

Sale of gas—		
Common gas per meter at 2s. 5d. per 1000 cubic feet (83,254)	£185,410 6 1	
Public lighting and under contracts, common gas	5,886 11 6	
	£191,296 17 7	
Less discounts and allowances	4,050 5 8	
		£187,246 11 11
Rental—		
Meters (24,060)	£2,883 14 6	
Stoves (48,044)	7,632 18 10	
Prepayment meters (58,418)	10,255 9 5	
Incandescent mantle maintenance	482 5 5	
		21,254 8 2
Residual products—		
Coke, less £4455 19s. 2d. for labour	£32,542 1 5	
Breeze, less £536 14s. 8d. for labour	4,173 15 0	
Tar	7,125 0 9	
Ammoniacal liquor and sulphate of ammonia	10,757 8 3	
		54,598 5 5
Miscellaneous receipts—		
Rent receivable	£53 12 0	
Transfer fees	29 10 0	
		83 2 0
Total receipts		£263,182 7 6

The following are the statements relating to the manufacturing operations of the Company in the half year:—

Statement of Coals and Oil.

Description.	In Store Dec. 31, 1906.	Received During Half Year.	Carbonized During Half Year.	Used and Sold During Half Year.	In Store June 30, 1907.
	Tons.	Tons. cwt.	Tons. cwt.	Tons.	Tons.
Common	21,998	102,265 13	105,435 13	847	17,981
Cannel	2,288	..	1,146 0	..	1,142
Total	24,286	102,265 13	106,581 13	847	19,123
Oil—gallons	312,133	1,253,339	1,206,567	..	358,905

Statement of Residual Products.

Description.	In Store Dec. 31, 1906.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store June 30, 1907.
Coke—tons	3,881	65,281	17,907	48,756	2,498
Breeze—tons	655	18,677	..	17,402	1,930
Tar—gallons	679,011	1,242,464	..	1,425,053	496,422
Ammoniacal liquor—butts	8,823	35,503	35,920	..	8,406
Sulphate of ammonia—tons	47	1,141	..	1,038	150

Statement of Gas Made, Sold, &c.

Quantity Made (meter register and estimated).	Quantity Sold.		Quantity Accounted for.	Number of Public Lights.
	Public Lights and under Contracts (estimated).	Private Lights, per Meter.		
Thousands.	Thousands.	Thousands.	Thousands.	
1,704,437	41,539	1,537,098	1,604,203	4016

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal,

oil, &c., £17,026; coke and breeze, £1886; tar, ammoniacal liquor, sulphate of ammonia, &c., £7842; sundry stores, £33,144—total, £59,898. A sum of £20,443 stands in the balance-sheet as employees' bonus and savings.

GAS SUPPLY AT NEWPORT (MON.).

A Bright Outlook—Workmen's Thrift.

The Chairman of the Newport (Mon.) Gas Company—Mr. R. Laybourne—was able to congratulate the shareholders, at the half-yearly meeting last Wednesday, on the favourable result of the working in the six months ending the 30th of June. The accounts showed a sum of £10,312 available for distribution; and in their report the Directors recommended the payment of the statutory dividends. The Chairman remarked that, owing to the advance in the price of coal, they had not been able to realize their hopes and expectations; but they had found it possible to give some relief to a section of their consumers by a reduction in the price of gas to be used in engines. When relief came to them in the shape of a reduction in the cost of coal, the Board would not be unmindful of the claims of other consumers. As to the future, when the Board could see their way to afford relief to their consumers without injury to the interests of the stockholders, they would not neglect to grant such relief. Owing to the extra cost of coal, some gas companies had found it necessary to advance their prices. But the Newport Company, having an option in their contracts to increase the quantity, exercised it; and this afforded relief during the last, and it was still operating in the current, half year. The prospects of gas companies were on the whole as bright as the light they supplied. The craze of electric lighting was passing; and as a result those cities and towns which had discarded its use in favour of gas were well satisfied with the change, and the immense saving was also highly satisfactory to the ratepayers. Referring to the accounts, Mr. Laybourne said that additional capital was required to meet the outlay on new mains in districts not previously supplied, and also an extension of coin meters, of which they had now in use 8818, together with 10,469 gas-cookers and 3142 gas-fires. To meet this expenditure, the Board decided to issue new stock to the extent of £15,851, which was done by advertised tenders, and realized a profit of £1777 in premiums. They had sold 15¼ million cubic feet of gas over and above that sold in the first half of last year; and, to compensate to some extent for the increased cost of coal, coke had, in sympathy with coal, realized better prices. The reserve and depreciation funds were in a healthy state, and the Thrift Society was being better appreciated by the employees, who had now, as a result of their savings, £849 standing to their credit, in addition to £800 of stock of the Company. The Board were gratified to find their workmen looking more favourably on this fund, which was established entirely in their interests. The result of their trading was that they were able to pay the statutory dividend without recourse to the reserve fund. The report was adopted, and the dividends recommended were declared. Replying to a vote of thanks to the officers, the Secretary (Mr. T. H. Hazell) remarked that they were proud to serve under so admirable a Board of Directors as those at the head of the Company; and the Engineer (Mr. T. Canning) said he had the greatest interest in the welfare of the concern. He added that the staff had done their work cheerfully, and that the business of the concern was increasing.

WATER GAS AT BELFAST.

In moving the adoption at the last meeting of the Council of the minutes of the Belfast Gas Committee, the Chairman, Mr. J. A. Doran, made some remarks with reference to objections that had been urged against carburetted water gas.

He said that in 1898 a Departmental Committee investigated the question; but since then no further action limiting the proportion to be used had been taken. To-day there were 108 companies and corporations throughout the country supplying carburetted water gas, in proportions varying from 2 to 67 per cent. of their total output—each one using the proportion found best suited to its needs. Some, indeed, had employed 50 per cent. and over for the past thirteen years, with perfect satisfaction to the consumers. Last year, the Belfast Committee's proportion varied from 22 to 45 per cent.; and it was not probable that a much larger percentage would often be required in future. But denial of liberty to make use of the system as required to meet emergencies would mean an otherwise needless expenditure on new works of half-a-million of money. It would be a great misfortune if a system so elastic, and tending so much to the welfare of the community, were to be hampered by arbitrary restrictions, and that without any just grounds for interference. Parliament evidently took this view of the matter, as no limit to its supply had been imposed. The only charge against carburetted water gas was the extra quantity of carbon monoxide it contained as compared with coal gas. It was represented as being more poisonous than coal gas, which was not true as regarded its constituents, but only as to the proportions. Coal gas contained a varying proportion of carbon monoxide up to 12 per cent., according to the coal used, and would destroy life if inhaled in quantity. Were it the case that coal gas was harmless, and carburetted water gas poisonous, the argument against the latter would be intelligible. Victims often succumbed to coal gas, and recovered from the effects of inhaling carburetted water gas; so that if gas poisoning was to cease, the supply of both must be done away with. From a hygienic point of view, no other charge had been made against water gas than that it was inimical to the public health. But, as a matter of fact, in the living-rooms of their population, it was much more healthy than coal gas, because not only was less oxygen required for its combustion, but it was practically free from sulphur compounds. Of course, it would be thoroughly understood that the gas which was being sent out was both useful and safe.

In seconding, Mr. Boyd said it had been stated that the quantity of carburetted water gas in the public supply varied between 17 and 45 per cent., notwithstanding the recommendations of the Departmental Committee. However, he would deal with the matter in committee. Mr. Barkley asked what was the relative cost of water gas and coal gas, and the relative profits from them. He would like to know, also, how often the percentage fell as low as 17, and how often it rose (and at what period of the year) to 45 per cent. He had tried to make inquiries about the matter, but had been put off with a bald statement. Mr. Doran replied that the cost of carburetted water gas was much less, it was very handy, and was a great saving to the ratepayers. The illuminating power was up to the standard of the Act—namely, 16 candles. Since Mr. Sharpe took over the management of the gas-works, there was no man who had paid more attention to his duties, or had done more in carrying out his work for the benefit of the community.

GAS AND ELECTRICITY AT MALTON.

The report for the six months ending the 30th of June which was presented by the Directors of the Malton Gas Company at the recent half-yearly meeting showed that, notwithstanding the keen competition of the Northern Counties Electric Light Company, who have secured the contract for the lighting of the public streets, and also certain motive power contracts in Norton, the Company are still holding their own. The Directors stated that the business was in a satisfactory condition; the increased sale of gas for the half year was equal to 5½ per cent., and the sales of residual products and gas-fittings have been more than usual. The profit balance for the half year was £1731. Adding to this the amount brought from the last account (£1665) and the interest allowed by bankers, a total of £3426 was available for the payment of dividends. The Directors proposed a dividend of 6 per cent.; after payment of which and other charges there would be a balance of £1861 to be carried forward. The total sale of gas for private consumption during the half year amounted to upwards of 26⅓ million cubic feet; and this, with the small portion of public lighting which the Company have in hand, brought in a total revenue of £3238. The Chairman (Mr. Hugh W. Pearson), in moving the adoption of the report, congratulated the shareholders on the very satisfactory results of the half-year's work, and on the sound position of the Company. There had, he said, been an increased consumption of gas equal to 5½ per cent.; and after paying their usual dividend of 6 per cent.—all earned in the period covered—they would be £200 better off than when they commenced it. He was afraid the increased consumption would not be continued. They had lost as customers the electric light people, who had used gas for their motive power, but had now put down gas plant of their own. He would, however, remind the shareholders that the Company had been supplying gas to the Electric Light Company at a very cheap rate; and the loss of their consumption would not be anything like so great as that of an ordinary consumer. They hoped to recoup this loss in great part by saving expenses. The Chairman concluded by alluding to the increase in the price of coal, which he attributed to the abolition of the tax, and said the Directors intended to wait to see if the present high figure was likely to be permanent before raising the price of gas. The report was adopted, and the dividend recommended was declared.

PUBLIC LIGHTING IN PADDINGTON.

Testimony in Favour of Gas.

At the last meeting of the Paddington Borough Council, the Works Committee submitted a report reminding the Council that a deputation attended before them on the 19th of February last with reference to the better lighting of Harrow Road, and read a memorial signed by nearly 200 ratepayers in support of their representations. The subject was referred to the Committee for consideration and report, and they had most carefully considered the whole matter. They had had a night view of the thoroughfare in question, and had some experiments carried out with improved gas and electric arc lamps. With regard to gas lighting, the Borough Surveyor (Mr. E. B. B. Newton) had submitted the following scheme for lighting a section of the road, by which every alternate light would be extinguished at 12.30 midnight: Existing lamps replaced by two-light No. 4 Kern burners, (1) initial cost £130, (2) actual cost £350; replaced by two-light inverted burners, (1) £190, (2) £330; by three-light burners, (1) £220, (2) £460; by five-light burners, (1) £280, (2) £720; by six-light burners, (1) £380, (2) £880. The Committee considered that this portion of the road could be satisfactorily lighted with 24 electric arc lamps, half turned out at 12.30 midnight, for the sum of £264 per annum (*plus* £10 initial cost for alterations to some of the existing lamp-columns), against £190 per annum for lighting with the present gas-lamps at the increased price of gas. They accordingly recommended that arrangements should be made with the Metropolitan Electric Supply Company, Limited, for the lighting with electricity of the portion of road specified at an estimated annual cost of £264 on an agreement for ten years, and at an estimated initial cost of £10 for alterations to certain existing lamp-columns.

The Finance Committee, in a report on the above matter, drew attention to the fact that the proposal opened up the question of electric lighting for the whole of the borough, which would involve the Council in additional expense. On the motion for the adoption of the report and recommendation, Mr. Blackwood moved a reference back. In the course of his remarks, he said he had tried the electric light himself and found it a failure; for he had better light with gas and had saved £10 a year. Sir George Fardell, in seconding the reference back, said he was astonished at the recommendation, which sought to bind the Council to a ten-years' agreement and to introduce electric lighting into the streets, which he contended were very well illuminated at present by gas. Mr. Muzzell said the electric light had been tried in Westbourne Terrace, and had not been a success. This had been shown by the fact that the Council had decided to remove the arc standards. Mr. Beverly said he had tried incandescent gas and electric light, and had found the former far cheaper and better. On a division, the reference back was carried by a majority of four.

WATER SUPPLY TROUBLES IN SPAIN.

The shareholders of the Seville Water-Works Company, Limited, had anything but an encouraging report to receive at their meeting last Wednesday; but the difficulties which make things as they are, are of a kind that no Board of Directors could control. Mr. Cowley Lambert, the Chairman, submitted the report of the Directors. In his speech, he said the shareholders would notice that the amount transferred from the profit and loss account was considerably less than it was last year. This was not due to any falling off in the business of the Company, because there had been a small increase of 2600 pesetas in the water-rentals. The difference in the profit for the year was to be found in the increase in the expenditure, due principally to special outlay on repairs and renewals of machinery, to the replacement of temporary and wasteful machinery by new and permanent plant of greater economy, to the repayment of the amount expended by the Municipality upon the upkeep of a bridge in previous years, for which the Company had been adjudged liable, to the larger amount of water taken from the Santa Lucia spring and aqueduct, and to the provision for arrears of taxation. The increase of expenditure under the heading of maintenance and repairs amounted to something like 12,415 pesetas. This was made up by 11,180 pesetas repairs to the bridge, which included a cash payment to the Municipality of 5000 odd pesetas in respect of maintenance since 1898. In connection with this, arrangements had been made with the Gas Company to pay 1000 pesetas per annum as wayleave for the main across the bridge; and the Directors hoped this would, in some measure, go to meet any expenditure upon the structure in the future. The amount of increase in maintenance was completed by 1200 pesetas on account of the bursting of a 21-inch main. The next point was the pumping and engine charges, which had increased by 17,756 pesetas. This was largely made up of extraordinary repairs which had been executed during the past year. The chief item, of course, of the extra expenditure was that of taxes. The Government had largely been, like the British Government, looking up the taxpayers; and the Board had considered it right and proper they should at once make provision for the payment which might be due out of the present balance-sheet. Expenditure in connection with the drought—amounting to 28,000 pesetas—included some new plant at Las Aceñas, which plant was much more economical in working. There had been an increase in the Santa Lucia water purchased of 23,000 pesetas. These were the items that brought up the expenditure of the year to such very large figures. But he might say, it was all abnormal expenditure, though as far as could be seen, the drought was becoming accentuated year by year, and nobody knew when there would be rain again. They were left with the small balance of £3153; and this, with the unappropriated balance of last year, made the amount standing to the credit of the profit and loss account £7453. It was proposed to carry the amount forward; inasmuch as during the next two years they had to pay off some £6000 of mortgage on the Clavinque property. The Directors considered their policy had been fully justified in securing a supply at Clavinque; for, if they had not done so when they did at a most critical moment, the position for the Company would have been a serious one. He was sure the shareholders would regret with the Directors the serious illness of Mr. C. A. Friend, their Manager, which had no doubt been brought about by the very great worry and anxiety that their business has caused him during the past few years, and which had led to his resignation. There was one further point of interest; and it was that the Municipality of Seville had apparently at length recognized the fact that shortness of water was not so much due to any want of *bona fides* on the part of the Company as to the act of Providence. An analysis in Mr. Friend's report of the extraordinary shortage of water during past years showed that last year the rainfall in Andalusia exhibited a deficiency of no less than 67 per cent. of the mean of 37 years. If the springs continued to fall as they were doing all round the hills near Seville, they would have to look to the River Guadalquivir for a supplementary supply. The motion was seconded by Mr. T. Percival Wilson. Subsequently there was some inquiry by shareholders into certain of the matters referred to by the Chairman; but in all cases it was seen that the inexorable conditions of the situation had not left the Directors any other course than that adopted. The acceptance of the report was agreed to; and a pension of not exceeding £200 a year was voted to Mr. Friend, "such pension to be payable only during the pleasure of the Board of the Company for the time being." The retiring Directors (Mr. Easton Devonshire and Mr. F. S. Jackson) were re-elected, as were also the Auditors. The customary acknowledgment of services concluded the proceedings.

Gas Poisoning Case at Oxford.—An Oxford carpenter, who was found in an unconscious state in his bedroom with the gas-jet partially turned on, subsequently died; and the Coroner's Jury returned a verdict that he was accidentally poisoned by coal gas. It was stated that deceased had not been in work since October; but that he was not a man likely to commit suicide. He had been in the habit of fastening his bedroom door; and the window was shut. The gas was alight when he went to bed; but the draught from a space at the top of the door might, one witness said, have blown the flame out.

Record Sale of Gas at Littleborough.—The sale of gas at Littleborough for the twelve months to June 30 amounted to 60,115,700 cubic feet—which was a record; the increased sales being due to the popularizing of gas for domestic uses, and not to an extension of the district. The production of gas per ton of coal carbonized for the year averaged 10,894 cubic feet, and the coke made for sale 10·8 cwt. At the recent half-yearly meeting, the balance-sheet was adopted, and a dividend at the rate of 10 per cent., less income-tax, was declared for the six months. There was a disposable balance of £2708. Satisfaction was expressed by the shareholders with the results; and votes of thanks were accorded to the Directors and to the Manager and Secretary (Mr. S. E. Halliwell) and other officers of the Company.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Perth Town Council sat specially on Monday to consider the accounts and estimates in connection with the various city departments. Mr. Hamilton, the Convener of the Gas Committee, submitted the gas accounts. The proposed increase of 3d. in the price of gas, he said, was to be attributed to the fall in the receipts from bye-products and the rise in the price of coal; but he was hopeful that the estimated income and expenditure would come out nearly correct. If the price of secondary products kept up, he was hopeful that there would be a satisfactory balance. An increase of 3d. per 1000 cubic feet of gas would produce £2250, or £750 for each penny. Lord Provost Cuthbert pointed out that only 35 per cent. of the gas revenue was collected at the office, and he thought a new departure should be made in regard to this. Only one out of every three consumers got discount. He was of opinion that, instead of the present discount, they should give a 5 per cent. rebate to consumers who paid at the office within twenty days. The system had been found to work well in Aberdeen and other places. He thought that would be a most popular departure, and should be considered by the Convener next year before he made up his estimates. The accounts and estimates were adopted, and the price of gas raised as proposed.

The Gas Committee of the Dumfries Town Council recommended the other day, by a majority, that the price of gas be raised by 2d. per 1000 cubic feet—from 2s. 10d. to 3s.—except when consumed through prepayment meters, which is to be retained at 3s. 6d. A firm in the town, who are large consumers of gas, wrote to the Council asking for special terms, on account of the size of their account. Their greatest rivals, the writers said, were in Aberdeen, where gas for lighting cost 2s. 7d., and for power 2s. 4d. per 1000 cubic feet; and in Glasgow, where the respective costs were 2s. 4d. and 2s. In Aberdeen a discount of 10 per cent. was allowed upon accounts of 500,000 cubic feet, making the net price 2s. 1d. In Dumfries, the discount upon a 2s. 7d. rate was only 4½ per cent. There was a long discussion in the Council; but not upon this somewhat threatening letter. The question which divided the Council was whether the price of gas should be advanced by 2d. or 1d.; the consideration which moved those who supported the 1d. increase being more the interest of the working classes than that of large consumers. In closing the discussion, Bailie Thomson, the Sub-Convener of the Gas Committee, said that they took into consideration the interests of all classes. All they wished to do was to see that the price was fixed at a figure at which the gas could be profitably supplied without any loss to the community. They were not paying off their debt as rapidly as they ought to do. His opinion was that at the end of the period the reserve fund should be used for this purpose. It was necessary that the debt should be paid off as quickly as possible, especially in view of the fact that it was now thirty years since they took over the gas-works. While they might scrape along with a rise of 1d., he warned them that the price of coal had possibly not yet reached its full height. The increase of 2d. was agreed to by fifteen votes to six; and the letter from the firm of power users was sent to the Committee for consideration and report.

The Gas Committee of the Kirkcudbright Town Council reported the other day that they had accepted coal tenders as follows: 50 to 70 tons of Muirkirk cannel, at 23s. 9d. per ton; 400 tons of splits at 16s.; and 400 tons of Sanquhar doubles at 14s. 3d. A letter from the Glasgow and South-Western Railway Company was read, intimating that the Directors had under consideration the lighting of their station premises in the town, and that, in view of the high price of gas, they had in contemplation the laying down of plant for the production of acetylene gas. Before, however, deciding definitely they wished to be informed if the Council could grant any reduction in the price charged, which is 6s. 3d. per 1000 cubic feet. Mr. Brown said that the Council could not do anything under present circumstances. The price of coal was so high that in other places they had been increasing the price of gas, whereas in Kirkcudbright they had been reducing it.

In the Grangemouth Town Council last week, Bailie Wood, in moving approval of the Town Chamberlain's report upon the burgh finances, said that, as regarded the gas undertaking, it was very satisfactory to know that they were in the strong position the accounts showed them to be in. He thought they had taken the right step in paying off the £764 which the transfer of the works had cost; and while they did not need to begin their sinking fund for repayment of their loans for another year, they would be in the position this year of having something to meet the increased price of coal.

In one of our Scotch daily newspapers I have this week seen an article dealing with agricultural affairs, which appears to be founded upon a report in the "Journal of the Board of Agriculture" regarding experiments at Kew, the object of which was to free the farmer of the troublesome pest known as the eelworm. The remedy recommended is sulphate of potash, along with deep ploughing, and for the sterilizing of infected land a dressing of gas lime. The lime it is recommended should be allowed to lie on the surface of the ground for some time, and then be ploughed in with a light furrow.

At the half-yearly meeting of the Coatbridge Gas Company on Thursday, it was reported that the Consumption of gas, including 2½ million cubic feet for motive power at a special rate, had amounted to 80,931,000 cubic feet—an increase of more than 9 millions over the corresponding half year. It was agreed to pay dividends at the rate of 11½ per cent. upon the original ordinary stock, and 8$\frac{5}{6}$ per cent. upon the later issues.

The annual meeting of the East Wemyss and Buckhaven Gas Company was held on Wednesday. The report of the Directors stated that there had been a large increase in the consumption of gas, and that the profit on the year's business was £519. A dividend at the rate of 4 per cent. was declared.

Two somewhat serious explosions of gas occurred in Glasgow—one in a tenement in Garngad Road on the evening of Friday of last week, and the other in a house in Argyle Street on Monday morning. The more serious of the two was the one in Garngad Road. A labourer named

Slaven, when he returned from work, noticed a smell of gas as he passed up the stair. A one-roomed house on the first flat was unoccupied, and Slaven went into it to search for the leak in the gas-fittings. He turned off the gas, as he believed, at the meter, and then struck a match. The explosion which followed produced so much damage to the property that the authorities ordered the tenants out and barricaded the street. Seven persons were injured, and were treated at the Royal Infirmary. Next day the circumstances of the explosion were inquired into by the Master of Works and several of the officials from the Gas Office. It was then found that the gas-meter—a prepayment one—had been wrenched from its position, with the object, it is understood, of getting at the cash-box. The police are investigating the matter. The explosion in Argyle Street was caused by Mr. S. Evans, the occupier of the house, striking a match in searching for a leak of gas. He was thrown out of the drawing-room, and was so severely burned that he was taken to the Western Infirmary for treatment. A partition wall in the house was damaged.

At the seventy-sixth annual meeting of the Banff Gaslight Company, the report of the Directors which was submitted was a very satisfactory one. A dividend at the rate of $4\frac{1}{2}$ per cent. was paid, and £31 was carried forward.

Mr. R. T. Leitch, in submitting the annual accounts to the Newport Town Council on Monday, brought out that the expenditure generally had exceeded the income by £175, but remarked upon the healthy condition of the Gas Department, in which there was a credit balance of £926. This figure was realized after setting aside £250 to a special reserve fund, paying off the annual instalment of capital and interest, and making a contribution to the meter and stove reserve fund. During the past six years the consumption of gas had gone up fully 75 per cent. The state of affairs, Mr. Leitch said, reflected great credit upon the Convener (Mr. John O. Robertson) and upon the Manager (Mr. John F. Black), whose services the Council and ratepayers alike heartily appreciated.

Cardiff Water-Works Inspection.—In connection with the annual inspection of the Taff Fawr Water-Works by the Cardiff Corporation last Wednesday, a visit was made to the site of the new storage works to be constructed at Llywnon. The capacity will be over 900 million gallons; and what is now a valley will be transformed into an area of water a mile long and a quarter-of-a-mile broad, with a depth of 70 feet, On the completion of the scheme (at an estimated cost of £230,000), it is anticipated that Cardiff's needs will be supplied for thirty or forty years to come. The party subsequently drove to the Cantreff reservoir; and at the luncheon which followed, the Lord Mayor (Sir William S. Crossman) proposed "Success to the Water-Works Undertaking." He coupled with the toast the names of Alderman David Jones, the Chairman of the Water-Works Committee, and Mr. C. H. Priestley, the Water Engineer. He had, he said, heard from the visitors many expressions of approval of the fine supply of water they had.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia.

LIVERPOOL, *Aug.* 10.

The market has been quiet during the week, there having been no special demand from any particular quarter. On the other hand, however, the shipments during July have heen heavy, exceeding those for the same month of last year by about 4300 tons, and this would tend to show that there is no accumulation of stocks at any point. Prices remain at £11 15s. per ton f.o.b. Hull, £11 16s. 3d. to £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. As regards forward delivery, the position is practically the same as it was at the end of last week. Business has been done over the near months at about prompt prices; but for delivery over the spring months, the prices held by makers have prevented business.

Nitrate of Soda.

This article is quiet but steady at 11s. $1\frac{1}{2}$d. to 11s. $4\frac{1}{2}$d. per cwt., according to quality.

Tar Products.

LONDON, *Aug.* 10.

The markets for tar products are still quiet all round, and there are not any signs of a great revival of business at present. Pitch is quiet; and consumers generally are disinclined to buy forward just now, unless they can purchase upon terms very little in advance of current prompt prices, to which, of course, dealers will not agree at present. Creosote is firm, but without very much doing. Prices are, however, well maintained, and, with every prospect of good business in the coming few months, will doubtless remain firm. Makers are well sold, and determined to hold their hands at present, unless they can get an advance upon to-day's values. Benzol, 90 per cent., is still depressed and difficult of sale. The same remark applies to nearly all refined products, all of which have been offering for both prompt and forward delivery at low figures without much success. .Carbolic acid appears to be rather firmer. Continental consumers have in some cases slightly raised their limits; but even now they are very much below the ideas of manufacturers. Crystals are dull, and altogether without interest. Creosote salts and naphthalene are both steady and in good demand. Anthracene is without change; and the quantities which are now made are very small. Tar is still sellnig well, but at moderate prices.

The average values during the week were: Tar, 15s. 6d. to 20s. Pitch, London, 26s. nominal; east coast, 25s. to 25s. 6d.; west coast, 23s. 9d. to 24s. 6d. Benzol, 90 per cent., $7\frac{1}{2}$d. to $8\frac{1}{2}$d.; 50-90 per cent., $8\frac{1}{4}$d. to $9\frac{1}{4}$d. Toluol, $10\frac{1}{4}$d. to $11\frac{1}{2}$d. Crude naphtha, 4d. to $4\frac{1}{4}$d.; solvent naphtha, 1s. to 1s. $2\frac{1}{4}$d.; heavy naphtha, 1s. $1\frac{1}{2}$d. to 1s. $3\frac{1}{2}$d. Creosote, London, $2\frac{7}{8}$d. to 3d.; North, $2\frac{1}{2}$d. to $2\frac{3}{4}$d. Heavy oils, 3d.

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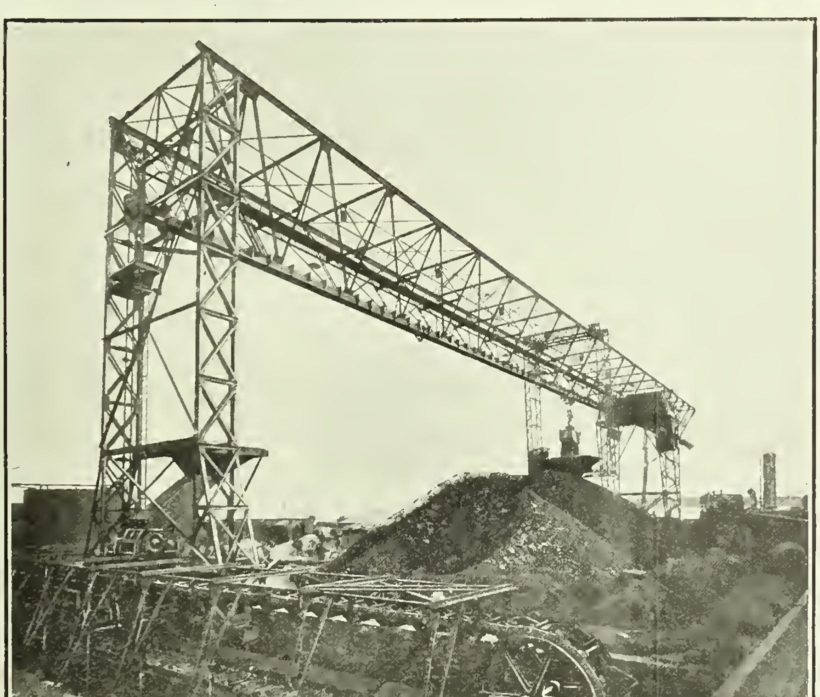

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Sulphate of Ammonia.

This article is unaltered, and very little business is doing. The principal London Gas Companies still ask £12 2s. 6d. to £12 5s. for forward delivery, and £12 1s. 3d. for prompt. Ordinary London makes can be bought at £11 13s. 9d. to £11 15s. In Leith, the ruling price is about £12 to £12 2s. 6d., Liverpool £11 16s. 3d. to £11 17s. 6d., and Hull £11 15s.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The holiday season may now be said to be at its height. Last week was a very broken one, and but little business was done on the Coal Exchange. Coal continues to command full rates. The large exports which are continually going out from both east and west coasts strengthens the hands of colliery owners, who are practically independent. A few days ago the writer found 17 boats at Hull waiting for coal cargoes, and there were also a number of like vessels at Grimsby awaiting their turns. The English Railway Companies in some instances have had to renew their contracts at an increase of 2s. and 3s. per ton. House coal, instead of being easier, is fetching still higher rates, and the prospects are not favourable to buyers. Gas coal and cannel are dearer on contract, though there is a lull in the present demand.

Northern Coal Trade.

There is a very strong demand for export, both of steam and gas coals; and it is probable that the quantities shipped foreign from the north-eastern ports have never been so high as they now are. Best Northumbrian steam coals are from 16s. per ton f.o.b., second-class steams are from 15s. to 15s. 6d., and steam smalls are 10s. to 10s. 6d. Work at the collieries is now again very full; and the large output is readily taken up—the inquiry being very strong from Germany and the Baltic. In the gas coal trade, the shipments coastwise are low—both through the season and owing to the diversion of some of that trade to Yorkshire—but the exports are heavy. Durham gas coals vary in price from 13s. 6d. to as high as 15s. per ton f.o.b., with, perhaps, 3d. per ton higher for one or two special qualities. As to contracts, more allotments have been made for some of the French towns—Rouen and Paris for instance. For delivery over one year, about 14s. 6d. per ton f.o.b. is believed to have been paid; and for delivery over two years, 12s. 4½d. is suggested as the figure agreed upon. One or two other contracts that have been postponed are also believed to be near settlement, but for small quantities only. Coke is very firm; and gas coke has advanced in price. The production is still limited; and from 18s. 6d. to as high as 20s. per ton f.o.b. is now quoted for good gas coke.

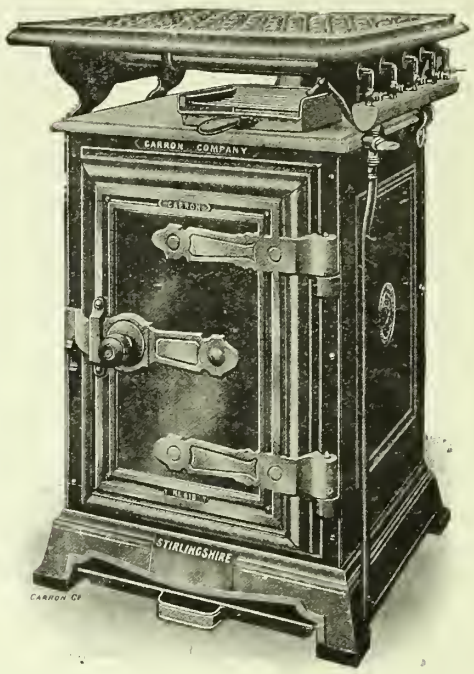
Scotch Coal Trade.

The market is strong and active; the foreign demand being particularly large. There is no appearance of a break in prices yet, but a gentleman who is well informed gives the opinion that prices will be greatly down before the year is out. The prices quoted are: Ell 13s. to 14s. 6d. per ton f.o.b. Glasgow, splint 14s. to 14s. 3d., steam 12s. 9d. to 13s. The shipments for the week amounted to 311,535 tons—an increase of 87,313 tons upon the previous week, and of 37,510 tons upon the corresponding week of last year. For the year to date, the total shipments have been 8,384,707 tons—an increase of 469,408 tons upon the corresponding period of 1906.

Colne Valley Water Company.—At the half-yearly meeting of this Company on the 2nd inst., the Directors reported a profit of £12,610 on the revenue account for the six months ending June 30, and a sum of £12,594 available for distribution. From this balance, £1000 was transferred to the contingency fund account; and dividends were declared at the maximum rates of 10 and 7 per cent. respectively on the two classes of shares—leaving £1292 to be carried forward. For the corresponding period of 1906, the dividends were at the rates of 9 and 7 per cent. respectively; and the amount carried forward was £1661.

Maryport Water Supply.—At a special meeting of the Maryport Urban District Council last Tuesday, a recommendation of the Gas and Water Committee to duplicate the mains between Papcastle and Hayborough at an estimated expenditure of £20,000, was adopted. An additional supply of water is needed to meet the requirements of the Flimby and Broughton Moor Coal and Fire-Brick Company, who are preparing new works at Risehow for which from 10,000 to 12,000 gallons per day will be wanted. More filter-beds are to be constructed; and an engineer is to be engaged to prepare plans, &c., of the entire work, in conjunction with the Council's Engineer. The matter was referrred to the Parliamentary Committee.

Water-Works Extensions at Hull.—The annual inspection last week of the Hull Water-Works by the members of the Water and Gas Committee, was made the occasion of a small ceremony; the Mayor (Alderman H. Feldman, J.P.) being invited by the Chairman (Alderman W. G. Wharram) to turn on the water from a recent adit extension at Cottingham. This work was commenced in 1905, and has just been completed; the cost being about £10,000. Five shafts (each about 80 feet deep), and three bores (each about 200 feet below the shafts) have been sunk. From here the greatest quantity of water pumped in one day is 9,633,000 gallons, though at the present time only 5,000,000 gallons per diem is drawn from the station—this being sufficient to meet requirements. The balance of the city's total daily consumption of 10 million gallons is obtained from other stations. Subsequently the machinery, &c., was inspected; and appreciation was expressed of the work of the Engineer, Mr. F. J. Bancroft.



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WORKS: CARRON, STIRLINGSHIRE.

SHOW-ROOMS:—LONDON (City)—15, Upper Thames Street, E.C.; LONDON (West End)—23, Princes Street, Cavendish Square, W.; LIVERPOOL—22-30, Red Cross Street; GLASGOW—125, Buchanan Street; MANCHESTER—24, Brazennose Street; BRISTOL—10, Victoria Street; NEWCASTLE-ON-TYNE—13, Prudhoe Street; BIRMINGHAM 218, 220, 222, Corporation Street; DUBLIN—44, Grafton Street.

Leatherhead Water Company.—The profit of this Company for the six months ending June 30 was £2246; and the amount available for distribution was £3641. At the recent half-yearly meeting, the Directors recommended a dividend at the rate of 10 per cent. per annum on the original shares, and at the rate of 7 per cent. per annum on the remainder of the shares. This would absorb £1919. They also recommended that a dividend at the former rate be declared for the half year ending June, 1885, on the share capital paid up at that date. The amount required for this was £875—making the total sum to be divided £2794, and leaving a balance of £846 to be carried forward. The Company's Engineer (Mr. F. Southwell Cripps) reported that the water supply had been satisfactory in both quantity and quality, and the plant generally maintained in good order.

The Standard Oil Company Heavily Fined.—The first stage of perhaps the most important case ever brought by the Federal authorities against a corporation closed on the 3rd inst., when Judge Landis, of the United States District Court at Chicago, inflicted upon the Standard Oil Company the heavy fine of $29,240,000 (£5,848,000). This sum was reached by the imposition of the maximum penalty for each of 1462 violations of the Elkins Anti-Rebate Law, of which the Company were convicted in their dealings with the Chicago and Alton Railway between September, 1903, and March, 1905. The Company will now appeal to the United States Circuit Court; and if found guilty, they will be liable to a fine of $38,440,000 under seven indictments now pending. It is stated that there are no less than 4422 counts under these indictments. Advices since received are to the effect that Judge Groscup, of the United States Court of Appeals, has granted an application for a writ of error in the case.

Effect of the Removal of the Coal-Tax.—At the half-yearly meeting of the Great Northern Railway Company last Wednesday, the Chairman (Lord Allerton), in moving the adoption of the report, said the increased cost of coal in the past six months was comparatively small compared with that which must appear in the accounts for the current half year. He did not want to alarm the shareholders, but they might take as the basis of their calculations that 1s. a ton increase in the cost of coal represented on the Company's consumption during the past six months £40,000 a year; and they were asked at the present to pay 3s. a ton advance. They would, therefore, see that the cost of coal was an extremely serious item. In the past six months they had had the advantage of contracts which were made at lower prices; and some of these contracts were still running. But this would not be the case beyond the end of the year; and then the Company would feel the full force of the enormous rise which had taken place in the price of coal.

New Joint-Stock Companies.—The Teneriffe Water Company, Limited, has been registered with a capital of £60,000, in £1 shares, to search for and obtain water from the extinct crater or natural basin known as Las Canadas, also water from under or near the peak called the Teide, situate in the Island of Teneriffe; to acquire any concessions, grants, decrees, rights, powers, and privileges from the Spanish Government, with a view to procuring water in the island or elsewhere in the Canary Islands; and to supply the towns or districts of and near Languna, or Santa Cruz, and the Orotava Valley. The Cook Gas-Engineering Company, Limited, with a capital of £5000, in £1 shares, is to acquire certain British patents relating to improved apparatus for increasing, regulating, and equalizing the pressure of gas, regulating gas-heated ironing machines, hand-irons, and laundry and cleaners' and dyers' apparatus; to take over the business of a gas engineer carried on by E. S. Cook at 17, Hanway Street, London, W.; and to manufacture and deal in atmospheric and other gas burners, fittings, mantles, and appliances, &c.

Large Water Scheme for Los Angeles.—An interesting project is forced on the people of Los Angeles, California, by the necessity of increasing their water supply. The place selected, says the "Los Angeles Times" (quoted in "The Times" Engineering Supplement), is the Owen River Valley, more than 200 miles north of the city and high up in the mountains. This valley is about 4000 feet above the sea level, and has a watershed of 2500 square miles. Through the valley from north to south runs Owen River, carrying an average daily flow of about 400 million gallons. The proposition is for the city to acquire by purchase the water rights of the valley, to dam the river 27 miles farther north, and by thus diverting it to carry the conduits to Los Angeles, 226 miles away. It will be the longest conduit in the world supplying a city with water. Though on its way from Owen River to Los Angeles the water must penetrate a great mountain range, it could be carried down by gravity alone without pumping or tunnelling; but it is thought better to construct 28 miles of tunnels. Five miles of this work will be in solid rock, under the mountains, in tunnels, 14 feet wide and 11 feet high, and will require five years to complete. The water needed for immediate use will be sent direct to the intake for Los Angeles, and the surplus will be sold for irrigation.

Cutting Off Water at Aldershot.—At the meeting of the Aldershot District Council a few weeks ago (see *ante*, p. 114) complaint was made by the Chairman (Mr. C. A. L. Calvert) that a consumer's water supply had been cut off for non-payment of his account; and he characterized this as a most arbitrary action on the part of the Gas and Water Company. After some discussion, the Clerk was instructed to write to the Company and suggest that, in the interests of the public health, notice should, in cases of the kind in question, be given to the Council. The Company wrote in reply that the matter had had the careful consideration of the Board, who wished to inform the Council that where it was necessary to discontinue the supply of water because of the non-payment of the rate, at least 24 hours' written notice was given to the consumer; and, if carried into effect, it had been the custom of the Company to notify the Council's Medical Officer of Health the same day. This coincided with the suggestion of the Council; and the Company hoped it would clear up any misapprehension in regard to the matter. After the letter had been read, the Chairman said a suggestion had been publicly made that the Council were inclined to dictate to other people certain courses which they did not pursue themselves. They had never prosecuted anybody for not paying his electric light account; and there was no comparison between electric light and water. The electric light was a luxury, and not a necessary of life, as was water.

THE NEW CUNARDERS

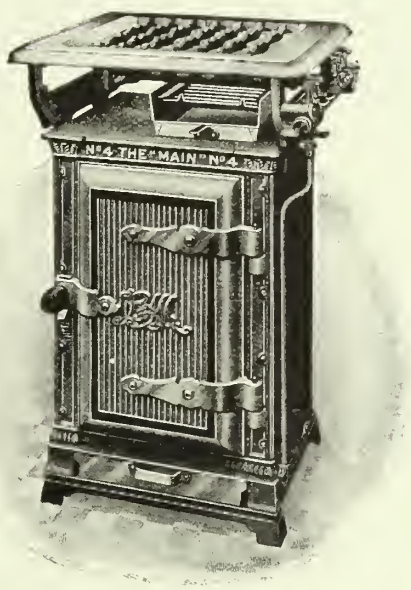
WILL RESTORE

BRITAIN'S SUPREMACY

ON THE MAIN

BUT

THE MAIN



IS ALREADY

SUPREME in the KITCHEN.

R. & A. MAIN, LTD.,
LONDON, GLASGOW, & FALKIRK.

Municipal Gas Supply in Sicily.

The United States Consul at Palermo (Mr. W. H. Bishop), in his annual report which has just reached London, gives an interesting account of the developments in relation to the acquisition of the gas undertaking by the Municipality. He says the purchase of the existing gas plant was voted in a referendum in April, 1906, there being 7988 votes in favour and 112 against in a total electorate of 18,821. The management was assumed by the City on Nov. 1, 1906. The sum paid was 4,750,000 lire (£190,000). The working staff in the service of the private Company was retained, and one of the first measures taken was to reduce the hours of labour to an important part of this force from twelve to eight per day; thus incurring in this respect a higher scale of expenditure. No lowering in the price of gas is expected at present. Much protest has already been made by the consumers on this account, and also on account of the alleged poorer quality of the gas, together with a lack of sufficient pressure to deliver it properly to the more distant parts of the town. The endeavour to furnish the pressure required increases, it is asserted, the bills of those living near the works. The Mayor issued an explanation stating that a large addition to the distributing system is needed; and he asked the public to have patience till the various difficulties of the new enterprise could be overcome. The Committee of Management, offended at the severe criticisms to which they were subjected, resigned. Following upon this the Municipal Council resigned in a body, and the Mayor with them; but it is hoped that these resignations will be withdrawn. The price of gas remains at 24 centimes per cubic metre, equivalent to about 5s. 5d. per 1000 cubic feet. This includes a tax of 4 centimes per cubic metre imposed by the National and City Governments—half by each. Gas for cooking and industrial purposes costs a trifle less; but as it is necessary to rent a separate meter for it, the difference, where the consumption is moderate, is scarcely worth mentioning. The annual rental for meters ranges from about 4s. 2d. upwards, according to the number of lights.

Price of Gas to be Increased at Durham.—At the half-yearly meeting of the City of Durham Gas Company, the Chairman (Mr. John Coward) said that, owing to the increase in the price of coal and oil, notice had been given that from the end of September the price of gas would be raised 2d. per 1000 cubic feet. The Directors had very reluctantly come to this decision; but coal was costing the Company 30 per cent. more than it did the previous year, which would make a difference to them of something like £1200 per annum. The profits for the six months to June amounted to £3198; and the sum available for dividend was £2920.

Increased Gas Consumption at Grantham.—In the report which was adopted at the half-yearly meeting last week of the shareholders in the Grantham Gas Company, the Directors remarked with satisfaction on the continued prosperity of the undertaking. There had, they said, been a very considerable increase in the consumption of gas during the past six months; and this, coupled with economical management, had placed the Company in an exceptionally strong financial position. Notwithstanding the large advance in the price of coal, the Directors did not contemplate increasing the price of gas; and in giving this benefit to the consumers, the Company would still, without difficulty, be able to pay the maximum dividend to the shareholders on the increased capital, without entrenching on the reserve fund.

"Kohlit" has been registered by Coalite, Limited, as the trade mark for their coal, coke, breeze, and partially coked coal.

The Directors of the National Gas-Engine Company have declared an interim dividend at the rate of 20 per cent. per annum for the six months ending the 30th of June.

It has been resolved in Belfast that boiling-rings, with metallic tubes and adapters, be supplied free to all gas consumers in future on application being made for them.

As the result of some lengthy trials in actual use, the Preston Corporation have placed an order for 250 Bellamy lamps with the Voelker Lighting Corporation, Limited, who own the patent for this lamp, and who have recently supplied more than 150 of them for Jamaica. There are about 15,750 fitted up in Liverpool; and the Borough Council of Finsbury are continually extending the use of them in their district.

The first annual sports of the employees at the Grangetown Gas-Works, Cardiff, were held on the 3rd inst., when about 1600 persons were present, including Colonel H. O. Fisher, one of the Directors, Mr. G. Clarry, the Secretary of the Company, Mr. Octavius Thomas (Pentre), and Mr. E. H. Swain (Pontypridd). A large programme was carried out successfully; the music being supplied by the works band. At the close of the meeting, Mrs. H. D. Madden presented the prizes to the successful competitors.

In a neatly printed official guide to Burton-on-Trent which is being circulated by the Town Council a short account is given of the gas undertaking, of which Mr. R. S. Ramsden is the Assistant-Manager, and attention is called to the specially low prices charged for gas used for heating purposes and gas-engines. These range from 2s. down to 1s. 6d. per 1000 cubic feet, according to the quantity supplied per quarter in one establishment; the last-named price being for supplies of 250,000 cubic feet and upwards.

According to the report of the Leeds Fire-Clay Company, the Directors have to deplore, for the fourth year in succession, the serious and unexampled depression in the building trade. The outlook a year ago was not then considered promising. But the demand for building material has since been even less throughout the whole country, and, as a consequence, there has been a further fall in the average selling prices, and the costs of production have been abnormally increased by the advances in the price of fuel, miners' wages, and stores. Sales were more than maintained during the year, but at prices which leave no margin of profit for dividends; the net results of the year's operations providing only for the payment of interest on debentures, £11,845, and the premium for the redemption of debentures, £2648 (the latter now amounting to £12,194).

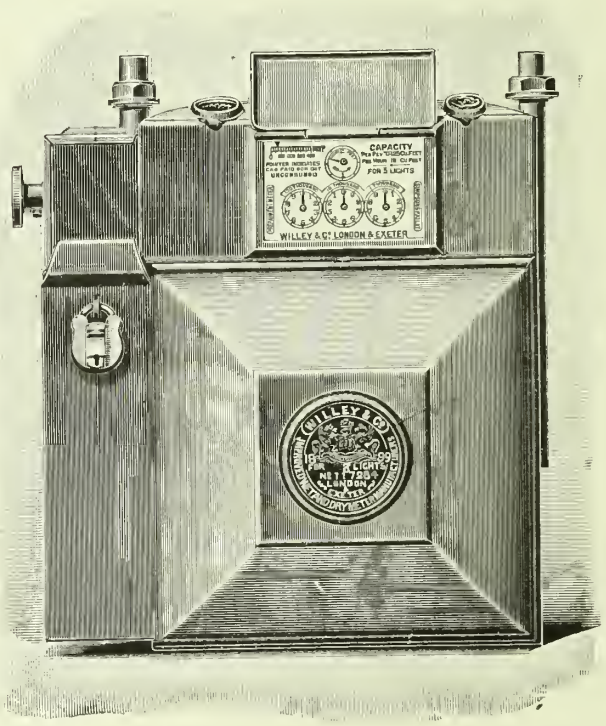
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.



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AGENTS FOR SCOTLAND:

D. M. NELSON & CO., 53, WATERLOO STREET. GLASGOW.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ENGINEER AND MANAGER. No. 4812. Applications by Aug. 19.
FOREMAN. Bridgwater Gas Company. Start Sept. 1.
IMPROVER. Newtown Gas Works.

Situations Wanted.

GAS FITTER. "C. K.," Barford St. John.
GAS AND WATER ENGINEER. No. 4798.
REPRESENTATIVE (GAS AND WATER). No. 4813.
WORKING MANAGER. No. 4808.

Partnership and Management (Lighting). No. 4814.

Tar-Works for Sale. No. 4799.

Company Meetings.

HARROW AND STANMORE GAS COMPANY. Holborn Restaurant. Sept. 2, Twelve o'clock.
MITCHAM AND WIMBLEDON GAS COMPANY. Offices. Aug. 27, Three o'clock.
NORTH MIDDLESEX GAS COMPANY. Offices. Aug. 28, 2.30 o'clock.
RIDDINGS GAS COMPANY. London Office. Aug. 30, 3.30 o'clock.

Plant (Second-Hand), &c., for Sale.

GASHOLDERS, PIPES, AND IRONWORK. Nottingham Gas Department. Tenders by Aug. 29.

TENDERS FOR

Breeze.

BRISTOL GAS COMPANY,
LEEDS GAS DEPARTMENT. Tenders by Aug. 24.

Coal and Cannel.

HAVERFORDWEST CORPORATION. Tenders by Aug. 19.
ISLE OF THANET GAS COMPANY. Tenders by Aug. 22.

Cookers.

BRITON FERRY URBAN DISTRICT COUNCIL. Tenders by Aug. 20.

Meters.

BRITON FERRY URBAN DISTRICT COUNCIL. Tenders by Aug. 20.

Oil for Gas Making.

ASHFORD (KENT) URBAN DISTRICT COUNCIL. Tenders by Aug. 20.

Oxide of Iron.

ISLE OF THANET GAS COMPANY. Tenders by Aug. 22.

Pipes, &c., and Laying.

BRITON FERRY URBAN DISTRICT COUNCIL. Tenders by Aug. 20
COVENTRY WATER DEPARTMENT. Tenders by Aug. 26.
PLYMOUTH WATER DEPARTMENT. Tenders by Aug. 29.

Roofs, Girders, &c.

COVENTRY GAS DEPARTMENT. Tenders by Aug. 26.

Tar and Liquor.

OSWALDTWISTLE GAS DEPARTMENT. Tenders by Aug. 24.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 436.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest-ment.
£			p.c.				£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd. . . .	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Feb. 28	14	Bournemouth Gas and Water 10 p.c.	27½—28½	..	4 18 3
51,810	10	,,	7	Bournemouth Gas and Water B 7 p.c.	16½—17	..	4 2 4
53,200	10	,,	6	Bournemouth Gas and Water Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	,,	12½	Brentford Consolidated	250—255	..	4 18 1
300,000	,,	,,	9½	Do. New . . .	188—193	..	4 18 5
50,000	,,	,,	5	Do. 5 p.c. Pref. .	117—122	..	4 2 0
206,250	,,	June 13	4	Do. 4 p.c. Deb. .	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c. .	119—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c. .	90—93	..	4 16 9
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
150,000	20	July 12	8¼	Cagliari, Ltd.	26—27	+½	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref. . .	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord. . .	109—111	..	4 10 1
1,443,280	Stk.	,,	5 2/10	Commercial 4 p.c Stk. .	103—108	−1	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do. .	100—105	−1	4 15 3
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk. . .	123—125	..	4 8 0
55,000	,,	Jan.	4	Do. Deb. Stk. . . .	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd. . . .	22½—23½*	−½	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17½—18½*	..	4 17 4
15,182,590	Stk.	Feb. 14	4 4/10	Gaslight and Coke 4 p.c. Ord. . .	94—96	..	4 11 7
2,600,000	,,	,,	3½	Gaslight and Coke 3½ p.c. max. . .	88—90	..	3 17 9
3,799,735	,,	,,	4	Gaslight and Coke 4 p.c. Con. Pref.	104—107	..	3 14 9
4,193,975	,,	June 13	3	Gaslight and Coke 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental .	173—175	−½	4 11 5
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c. .	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest-ment.
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A . .	221—223	..	4 9 8
718,100	,,	,,	7	Do. B .	164—165	..	4 4 10
152,736	Stk.	Feb. 14	7⅝	Maidstone 5 p.c. . .	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb. .	100—102	..	4 18 0
250,000	100	,,	4½	Met. of Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 9
1,775,892	Stk.	Feb. 28	4⅝	Newc'tle & G'tesh'd Con.	108—110	..	4 4 1
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	93½—94	−¼	3 14 6
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd. . . .	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd. . .	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord. . . .	6¾—7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref. .	4⅞—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb. .	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord. . .	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd. . . .	12¾—13¼	..	6 0 9
125,000	50	July 1	5	Do. 5 p.c. Deb. .	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	246—248	..	4 0 8
209,984	,,	,,	10	Do. B	246—248	..	4 0 8
523,500	,,	,,	10	Do. C	246—248	..	4 0 8
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,429,895	Stk.	Feb. 14	5½	South Met., 4 p.c. Ord.	120—122	..	4 10 2
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	82—84	..	3 11 5
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159—161	..	4 19 5
605,000	Stk.	Feb. 28	5½	S'th Suburb'n Ord. 5 p.c.	117—121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 1 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord. . .	105—110	..	4 10 11
120,000	Stk.	Feb. 28	6¾†	Tottenham and Edmonton A 5 p.c. .	123—126	..	5 3 2
398,940	,,	,,	5¼†	Tottenham and Edmonton B 3½ p.c. .	100—103	..	4 17 1
149,470	,,	June 27	4	Tottenham and Edmonton 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c. . .	—	..	—
255,636	,,	,,	6½	Wandsworth and Putney B 3½ p.c. . .	131—136	..	4 15 7
75,000	,,	,,	5⅗	Wandsworth and Putney C 3½ p.c. . .	—	..	—
80,075	,,	June 27	3	Wandsworth and Putney 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Feb. 28	5⅛	West Ham 5 p.c. Ord. .	102—105	..	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 1 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div." † Next dividend will be at this rate.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE,

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

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Water Engineer.
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Aug. 9, 1907.

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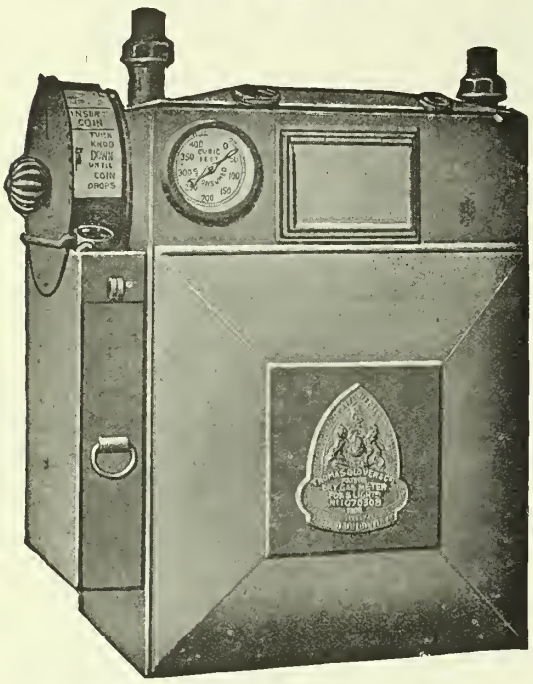

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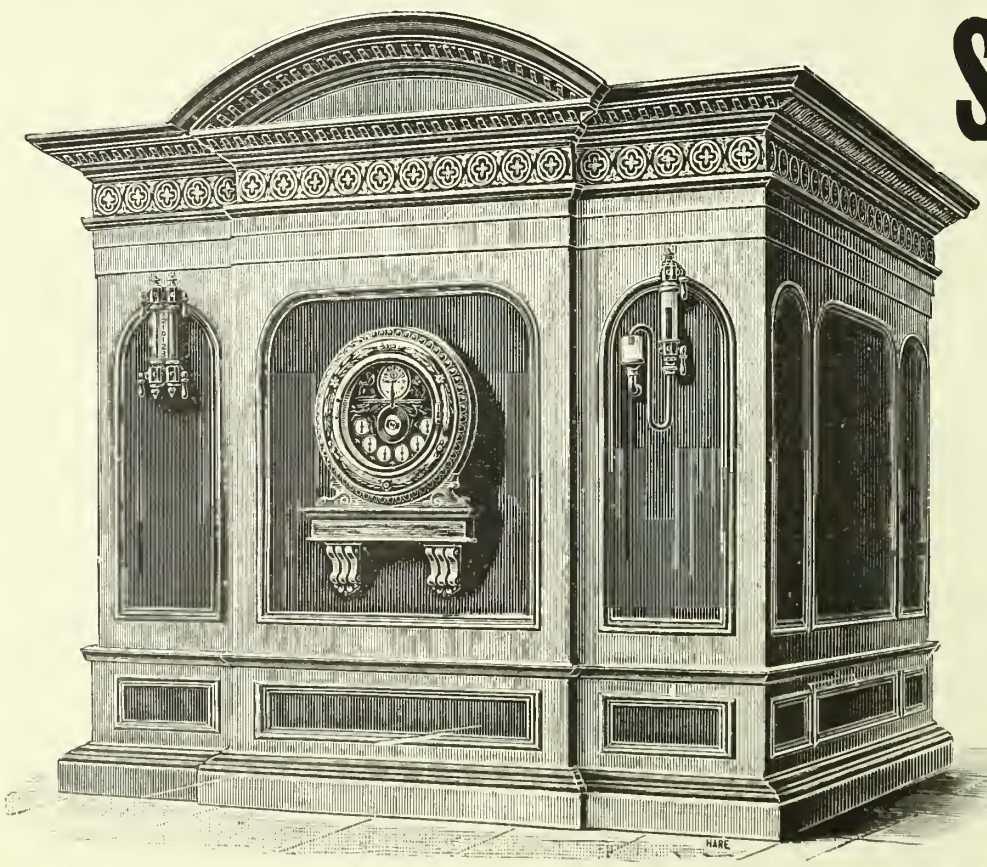

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. XCIX., No. 2310.——TUESDAY, AUGUST 20, 1907.

EDITORIAL NOTES—GAS, &c.

Gas and Coal Prices at the South Metropolitan Company's Meeting.

WHATEVER may have been the reason—whether it was singly or combined the questions of the price of coal, the prospective small reduction of dividend owing to the increased price of gas, or the placing of the Workmen Directors in greater security in regard to their tenure of office, did not transpire—the gathering of the proprietors of the South Metropolitan Gas Company at the Cannon Street Hotel last Wednesday was numerically quite out of the ordinary for an August meeting; but there were many among the proprietors who went away grievously disappointed. The cause is one for which there is no doubt a remedy; and we feel sure that Sir George Livesey and his colleagues will be only too pleased to have the matter brought to their attention, so that the remedy may be sought and applied. The acoustic properties of the Great Hall at Cannon Street Hotel have never been of the most satisfactory; and latterly there appears to have been an increase of external noises which diminish within the travelling power of the voice and curtail the range of the ear. Sir George had to request the repetition of a question at the close of his speech; and we can assure him that his difficulty from his central vantage ground was nothing compared to that of his great audience, not only on the fringe of the gathering, but several rows of seats nearer the Directors' table. The continuance of this will not do. The South Metropolitan Gas Company are the most democratic in the country; their meetings the best attended and most popular; and proprietors in such large numbers are not drawn to them merely for the satisfaction of hearing a few stray words. They ought not to be disappointed.

Having discharged what we conceive to be a little duty, there are two or three of the general subjects that were before the meeting that are open to comment. Brief consideration was given in last week's issue to the somewhat contrary administrative policies which influence the raising or the maintenance of the price of gas when higher manufacturing costs obtain through outside pressure. This was Sir George's leading theme, from which depended other matters, in the thoughtful address he delivered with the zest of one put on the defensive, and possessing the ability to perform his part. The Company have, owing to the largely increased cost of coal, raised the price of their 2s. gas, while other Companies with higher prices have not done so, or have advanced by a smaller amount. And there are people asking for the obvious explanation. Past policy sways present doings; and there are two policies which affect the current question of the relation of coal and gas prices. Both policies have their good points; and it is not Sir George who offers any prim precept which would inferentially deny that the policy that was not that of himself and his colleagues in this respect was the incorrect one, but practice discloses preference. It has been the policy of the South Metropolitan Company, while not neglecting the reserves *pro re natâ*, to, as soon as the undivided surplus admitted, reduce the price of gas, and so give the consumers the benefit of low charges as frequently and for as long as possible. On the other hand, there are managements that, when conditions are propitious, accumulate surpluses, and that consequently, when such adverse circumstances befall as the present, find themselves in a position to prolong the time before an increase in price is inevitable, or, perhaps, to stave off the evil day altogether. As to which is the better policy, it is difficult to speak dogmatically; but the *pros* and *cons* are well worth discussing.

There is a great deal to be said in favour of, according to the circumstances of the time, bed-rock prices for gas. Such prices are undeniably the best for promoting the expansion of custom, of which it is an excellent thing to procure as much as possible when prices are low to assist the position when prices are above the normal. But, on the other hand, the accumulation of a surplus in good times, by not working down to the finest possible charge for gas, does assist in keeping prices more uniform; does help to obviate the difficulties that arise through prepayment consumption having to be altered on changes in price; and is also helpful to the general consumers, inasmuch as, when the price of gas goes up, then, too, is the period when, as a rule, other commodities—such as the competing fuel coal at the present time—are not at their lowest values. Sir George is continually exhorting to providence and preparation for rainy days in the personal aspect of life; but *primâ facie* his speech on this occasion seems to rather violate his principles in their application to this particular feature of Gas Company management. But his reply to this would be that a contented *clientèle* in normal times is a better protection when working conditions are uncompromising than a large floating balance of undivided profit. There is another phase of the matter upon which he remarked in his speech. If, he says, the Company had accumulated large balances, and so had found no necessity to increase the price now, the consumers might reasonably have said: "How these Gas "Companies must have been fleecing us in the past, if they "can go through these extremely adverse periods without in- "creasing the price of gas!" This statement he follows up with one to the effect that consumers in the South Metropolitan district, having had explained to them, through a circular, the cause of the increase in price from 2s. to 2s. 3d. per 1000 cubic feet, have not complained. It may be submitted that the consumers would equally appreciate the very good reason supplied by an accumulated balance (to the production of which they had contributed) as to why an increase in the price could be deferred when market vagaries induced an augmentation in manufacturing costs.

Another point of view (which may be conveniently introduced here) regarding this matter of low prices and undivided balances was taken by Mr. H. E. Jones, at the Wandsworth Gas Company's meeting. Mr. Jones sees in the undivided balances in the hands of Gas Companies something to attract the eyes of mercenary coal proprietors. His ground for suspecting these gentlemen is that, previous to the coal contracts for the present year being negotiated, a Sheffield paper (as was announced in the "JOURNAL" six months ago) spoke of an arrangement having been effected between the coalowners of four counties, "with a view to so lifting contract "prices for gas coals, that a portion of the large profits now "being earned by Gas Companies in all parts of the country "should be transferred to the colliery owners' pockets." But coalowners apparently have little regard for the condition of the exchequers of their customers, nor for the fact that in many Gas Companies the proprietors have not been dividing profits up to the limits defined by the operation of the sliding-scale, for the coalowners have dealt their heavy blow on this occasion with a fairly impartial hand. However, on the general question of the policy of the lowest price as against goodly accumulations of undivided balances, with us—although the case from the opposite side has been put somewhat strongly—the preference inclines to the sound principle of supplying at the lowest reasonable price, to the promotion of the current and lasting interests of the business, and because (providing adequate attention has been given to the funds for special emergencies) inflated undivided balances are opposed to the very essence of the sliding-scale.

It is impossible now to refer to the coal question, at meetings of companies engaged in industrial pursuits or in public service—no matter the political colour of speakers or hearers—without denouncing the abolition of the coal tax as a false step, the taking of which was prompted by the spurious sentiment and righteousness so freely scattered by the coal owners and miners. The speciousness has been found out, and having been found out is being condemned with might and main by those who are the victims of the error of judgment on the part of the Chancellor of the Exchequer. This is not a party question; it is a national one. And most

Chairmen of Gas Companies have so recognized it during the present half-yearly meetings. Sir George returned to the charge at the meeting of the South Metropolitan proprietors; and he did not leave it until he had made a point at the expense of Mr. Asquith, which exposes the ludicrousness of a claim by the right honourable gentleman, which claim he may possibly wish some day, if he has not done so already, had been numbered among (as Mr. "Punch" would put it) those things he would rather have left unsaid. Mr. Asquith, asked in the House of Commons what he had done to reduce taxation in this country, hoisted high the abrogation of the duty on exported coal. This is really ineffably funny. To cut off revenue coming from an outside source is a singular way of reducing taxation within the country; a plan engrained with a great deal more sense would have been to have doubled the tax, and thus increased the revenue. Not only has there been loss of revenue to the country, but the captains of industry on all hands, with the exception of a few whose party spirit rise superior to a question of national economics, have condemned the removal of the coal duty as having aggravated a condition of things that has produced an increased cost upon the people of the country, and upon its industries, and that bids fair to disorganize transport to the detriment of home industry and general comfort in the coming winter. Mr. Corbet Woodall is a Director of the Imperial Continental Gas Association and Chairman of the Danish Gas Company; Mr. H. E. Jones is a Director of the European, the Bombay, and the Primitiva Gas Companies—all of whom are operating abroad, to large extent, with British capital. Nevertheless, these gentlemen have not a good word to say for the abolition of the duty. They would much rather—quite apart from their home interests in the gas industry—have continued to pay the duty than have had to face a considerably higher price for coal and, in addition, congested ports. Mr. Asquith may flatter himself for having relieved the foreign buyer at the expense of the British taxpayer and industry; but we have not all reached those altruistic heights at which, for such an action, for such an error of judgment on the part of one sitting in a high and responsible place, we can contentedly and without murmur pay such a penalty as we are now doing. No one is, of course, so unreasonable as to assert that this removal of the export coal duty is the sole cause of the higher prices for coal; trade prosperity is a further cause. But the gas industry furnishes a fairly good index of general trade prosperity; and of late progress in the industry has been, speaking generally, only about at normal level. It was suggested in the speech of Sir George that the country would have been better off with a 2s. export duty than it is now through its withdrawal. Mr. Fell called the attention of the House of Commons to this suggestion last night by a question to the Chancellor of the Exchequer; but Mr. Asquith said he was not prepared to consider the re-imposition of a duty.

There were several other matters discussed by Sir George at the meeting—both general and domestic; the former including the serious one of the assessment of gas-works property, and the latter the system of Workmen Directors. A periodical limit has to be named before the lapse of the preceding period for the continuance of the operation of the Workmen Director scheme; and so well do the South Metropolitan Gas Company, like the South Suburban Company, regard their experience of Workmen Directors, that a further period has now been fixed extending to 1950, subject to certain controlling conditions. The South Metropolitan Company are to be complimented on the grand object-lesson they have supplied to industry in the co-ordinating of the interests of capital and labour, with such effect that all such agencies as conciliation and arbitration for the composing of labour difficulties are consigned to the category of mere superfluities.

Commercial Gas Company Affairs—Prepayment Gas-Meter Robberies.

The proprietors of the Commercial Gas Company, through the positive evidence of the half-yearly accounts, aided by the breezy confidence of their Chairman (Mr. W. G. Bradshaw), were able to leave their meeting last Thursday with hopes undamped. The financial affairs of the Company were noticed last week; but the Chairman threw some light on the policy of the Board in connection with the coal situation. The price of gas has been raised by 1d. to 2s. 6d. per 1000 cubic feet; but the Company is one of those with a comfortable balance of undivided cash. The fluctuations of the markets for materials in the course of the past twenty years have caused the Board to adopt a preparatory policy with regard to them, and to accumulate a substantial sum so as to keep down the price of gas and maintain the dividend. The attitude of the Board in relation to the coal market has been to confine purchases to Durham, owing, the Chairman informs us, to the greater make of gas per ton, and to the anticipated congestion of the ports in communication with the Yorkshire coal-fields. The Chairman had a word of congratulation for the Board and the executive officers of the Gaslight and Coke Company upon the improved position and prospects of the premier undertaking. The "Coalite" people will take note that, if there is a profitable demand for a smokeless fuel of a character and quality different from that already distributed by the London Gas Companies, that all three are prepared to do their part in meeting the demand. The Gaslight and Coke Company have already taken action with "Carbo;" Sir George Livesey spoke his mind on the subject at the Engineering Conference; and now the Chairman of the Commercial Gas Company has made an announcement which means that they will not unwilling to oblige the people of their district, if the demand arises—all of which indicates that the Coalite Company, with their hyperbolical views and pretensions, are not going to occupy any position in the fuel market unchallenged by those in prior possession of it.

Another matter raised at the meeting was the question of the pilfering of prepayment meter cash-boxes. In February last, the Chairman stated that the robberies in the Company's district were not very numerous; but it now seems they are sufficiently so to attract the attention of local proprietors in the Company, and to come before the Board for special discussion. Mr. Bradshaw acknowledges the difficulty of the question, and puts his finger on the weak spot of the prepayment equipment when he describes the coin meter as a "flimsy thing." But he does not know what can be done without going to great expense, though from the point of view of morality, he would be very glad if a remedy could be applied. To ease his conscience in this matter, the way seems clear. The flimsiness of the coin meter is the acknowledged tempting fault; therefore the coin-box of the prepayment meter requires strengthening. It follows that what Mr. Bradshaw has to do is to suggest to his colleagues that only prepayment meters with specially strong boxes should in future be fixed; that as existing meters are taken out for repair, the stronger money-box should displace the weaker one; and that in those localities specially affected by depredators, the meters should be changed for those with thief-resisting cash-boxes. The process of extirpating the flimsily constructed money-boxes would be a gradual one, and thus would not occasion any great lump additional expense. A little enlightenment may perhaps be obtained from the articles on the subject in the "Journal" for Feb. 5, p. 333, and April 9, p. 90.

Gas-Works Rating—Suggested Action.

"Coming events" are said "to cast their shadows before "them." Does the reference to the subject of rating by Sir George Livesey, at the South Metropolitan meeting, foreshadow an active attempt to establish the rating of gas-works on a more rational system than the present? No system of rating can be regarded as satisfactory which has nothing better at its roots than a hypothesis which can be squeezed, stretched, and distorted according to individual fancy, and which yields, through lawyers and experts, a confusing mass of figures from which an incompetent Court is expected to extract justice. Sir George was not sparing in his condemnation of the system; and the day before Mr. H. E. Jones was equally incisive over its shortcomings, at the meeting of the Wandsworth Gas Company. It never was without its faults, even when the subjects to be assessed were not so variable in character and purpose as now; but what has been tolerated in the past will not fit the present. There has been some spasmodic and independent effort at obtaining a fairer system by certain Gas Companies, and chiefly by the South Metropolitan Company, whose action both at Quarter Sessions and in the High Court has unfortunately so far proved abortive. For this, apparently, Sir George does not blame the Court of Quarter Sessions so much as the system; he probably takes the generous view that the Court as constituted did not understand the question, and in its wisdom declined to commit itself further than by the unsatis-

factory method of saying the "appeal is dismissed." What is wanted is a rational system of assessment, and the placing of the rating of such complicated undertakings as those engaged in gas supply in the hands of impartial and qualified men. How is this to be accomplished? The question is too big for any off-hand answer. But what should be the first step in the matter, is suggested by Sir George Livesey. "I think," he says, "the Gas Companies would do well to "take action themselves (it might be started in London in "the first instance), to promote a Bill in Parliament for the "rating of Gas Companies on a fair, clear, and under-"standable basis. Of course, such a Bill might not be "passed; but at all events it would open the subject, and "show the necessity of something of this sort being done." It seems evident from this that we shall not have to wait until the next quinquennial reassessments before we hear more of the rating question.

It is a pity the consumers of such things as gas and water cannot bring their weight to bear upon the matter. The conditions in London are so complex that it is the most difficult thing imaginable to get ratepayers or a class of consumers to act in a body; and of all questions, they do not generally appreciate how this one of assessment affects them. Gas and water undertakings, as Mr. Charles Hunt pointed out in his Presidential Address to the Institution of Gas Engineers in June, pay away a much heavier percentage of their receipts in the shape of rates than any other trading business [see "JOURNAL," June 25, p. 991]; and it would not be amiss if consumers raised their voices in common protest against the cost of these two necessaries of daily life being unduly burdened in this way. The figures quoted by Mr. Hunt were furnished by the South Metropolitan Gas Company; and they showed the actual gross receipts of various trades in South London, together with the amounts paid in rates, and the percentages of rates paid on the gross receipts. The average paid by the trades quoted in the table was 0·925 per cent. of the gross receipts; and by the South Metropolitan Gas Company no less than 6·6 per cent. of the receipts from gas. Cheap as gas is in South London, consumers will see from this that they not only contribute heavily to the local expenditure through their own direct rates, but indirectly through the gas they use, while consumers of paraffin oil and the dearer electricity get off much lighter in indirect taxation. What is wanted is a revision of the rating system; and what is now suggested is that gas undertakings should by persistent action insist upon being heard, and having not special favour, but justice meted out to them.

The Irish Association Meeting.

NOTWITHSTANDING that, as the President said, the annual meeting of the Irish Association of Gas Managers was overshadowed by the holding of the meeting of the Institution of Gas Engineers in the same city two months ago, the gathering of Irish members in Dublin last week gave no indication that the smaller body had, in any way, suffered from the visit of the larger. The attendance, and the quality of the programme provided, fully justified the Association in holding their annual meeting at the usual time of the year.

The premier position in the programme must be given to the address of the President, Mr. T. J. Reid, of Ballina. It was somewhat long; but it was couched in vigorous and characteristic language, and contained numerous pointed criticisms of existing methods of working and sage advice as to improvement. It would almost seem as if Mr. Reid's isolated location has specially fitted him for cultivating the faculty, as he puts it, of getting outside his work. His very sensible advice to others he puts in practice himself; his remarks bearing as much the character of one who views from over the way, as of one who ponders from within. Particularly interesting was the portion of his address dealing with the financial policy to be followed by the administrators of gas-works of limited magnitude. The President is all for caution, and rightly so, in the adoption of new schemes in connection with small works. It would also appear that he is desirous of reconstructing capital accounts, so as to simplify the financial side of gas undertakings. In small undertakings, and particularly so in diminishing towns, the capital account is the greatest source of weakness. In a concern which is progressive, the capital account may be kept open, and little or no drawback be felt; but when the tide is on the ebb, how to keep the body afloat is a question of great anxiety—there being, in the constitutions of companies, no provision made for the extinction of capital equivalent to that statutorily imposed on public bodies. Mr. Reid longs for the advent of a modern financier, who would imbue the companies with new life; and he looks for some relief to the tightness of the money market, by getting Irish people to invest in Irish gas companies. The question of finance is one that is always worth serious consideration; and Mr. Reid's leanings, it may be freely conceded, are in the right direction. His remarks as to the selling price of gas may not be fully appreciated by many; but they will bear consideration, especially by managers of small works in Ireland.

An old subject in a new dress was brought before the meeting in a paper by Mr. R. F. Byron, of Nenagh. He pleaded for equality in the conditions of supply between the prepayment and the ordinary consumer; and he asks for this because he finds that the prepayment system as customarily applied presses hardly on the best of the prepayment consumers. The prepayment system had not long run its course before this was perceived; and we remember a discussion by gas managers on the subject in those early days was conducted with closed doors, in the fear that some mischief might be done the system by the leakage of the intelligence to the public. But too much sentiment must not enter into this question of equality as between the prepayment consumer and the ordinary one; for in obtaining a superficial equality (which Mr. Byron will not achieve until he is in a position to drop the ordinary meter-rents), there is the danger of inflicting an injustice on the better-class, or ordinary, customers. Of course, it must be remembered that Mr. Byron supplies in a small town in which the price of gas is 6s. 8d. per 1000 cubic feet; and the prepayment consumer there would be a sort of *rara avis* if on that price an excess of 10d. or 1s. had to be charged for meter and fittings. Mr. Byron does not charge meter-rents for prepayment meters, and he leaves the consumers to provide their own fittings; but he (for the time being) is charging meter-rents to the ordinary consumers. Even when he drops this rent, the higher capital cost of the prepayment meter, the lower average consumption of the prepayment class of consumer compared with the ordinary, and the increased costs attaching to collection, and so forth, would still keep in existence an inequality to the detriment of the ordinary consumer. The fact that one class of consumer pays cash in advance, and the other class takes credit, would not wipe out this inequality. There is only one way of obtaining an approximate equality, and that is by levying a specific rent for the different types and sizes of meters, and for the fittings and appliances supplied, and charging the same price for the gas consumed. This all calls to mind the articles and controversy in the "JOURNAL" a few years ago on "Stops—not Slots," in which it was shown that, under the rentals of the "stop" meter system, the good prepayment consumer is not taxed for being such through the accumulation of the ninepences or tenpences per 1000 cubic feet as his consumption expands; but he pays in the way of rent for the accommodation afforded him a precisely similar amount to his neighbour with the same accommodation, but who consumes perhaps only a tithe of the quantity of gas. We do not think that in a town so large that the personal influence of the manager could not be brought to bear, Mr. Byron's plan would do much for the development of the prepayment meter system. It just stops short at the point where the poor householder finds the prepayment gas system as ordinarily applied exactly fits his circumstances.

The contribution of Mr. W. H. Roberts, of Newtownards, it is to be feared, will not afford much guidance to the managers of small gas-works as to whether or not it is advisable to instal a water-gas plant for emergencies. His view is that such a plant in a small works would not pay save for emergencies, and in a case where it would defer for a time heavy capital expenditure on some other plant. For emergency purposes only, the cost of the gas per 1000 cubic feet would be greater than where it was regularly produced; and the use of the gas for emergency purposes only would also be somewhat of a nuisance to the consumers where the total quantity of gas distributed was of limited amount. A far more interesting part of the paper is Mr. Roberts's brief account of what he has done to reduce the price of his gas from 3s. to 2s. for trade purposes; and upon this point he can speak with greater assurance and authority. We venture to say that he would be prepared to tell us that the day business he has obtained by keeping out suction gas plant, and displacing steam and other means of motive power, by the aid of 2s. gas has been far more beneficial to the

consumers of comparatively small quantities of gas for lighting and other purposes at 3s. per 1000 cubic feet, than would have been the loss of those trade consumers. That is a point which has frequently been made in the columns of the "JOURNAL."

The Audit of Municipal Accounts.

In spite of the continual outcry respecting the block of parliamentary business, it is to be hoped that time will shortly be found for dealing with the vexed question of the auditing of municipal accounts. No one thoroughly acquainted with the subject can pretend that the present system is satisfactory. In theory, it is quite right and proper that the auditors should be elected by the ratepayers, whose interests they are supposed to safeguard; but in practice this advantage is not found to confer much benefit upon anyone. As no qualification is specified for the office, persons without experience in auditing may be elected, as they often are; while in the absence of directions as to the duties to be performed, the extent of the audit is left entirely to the discretion of the persons filling the office. The Joint Committee of the two Houses of Parliament on municipal trading rightly came to the conclusion that this system fails to supply an effective audit. It admitted that in some cases Elective Auditors are able to lay a finger on a particular irregularity, but thought that such discoveries might equally be made by any active ratepayer, whether an Elective Auditor or not. Nor had the Committee anything more favourable to say for the alternative method of audit by the District Auditors of the Local Government Board. These gentlemen have, it is true, the power of surcharge; and, where they exercise their functions, they no doubt do put some amount of restraint upon certain kinds of unauthorized expenditure. But, as is frequently urged by municipal corporations, they are not, as a rule, accountants; and in the opinion of the Joint Committee they are not properly qualified to discharge the duties which are required in the examination of municipal accounts in these days. A better system than either that which exists or that which is offered as an alternative is clearly required. The Taunton Town Council, like many other municipal bodies, have been urged by some of the members who are dissatisfied with the present audit to adopt the Local Government Board system; and they have declined because it offers only a change from what the Town Clerk described as one defective system to another. At a meeting of the Council last week, several members strongly animadverted upon the defects of the present system and the want of effective control of the accounts; but there was no getting over the fact that the only other method available is little, if any, better, and that it would need a Special Act of Parliament to apply it. Under these circumstances, the majority of the Council decided to do nothing, pending the expected action of Parliament in the matter. Mr. John Burns is credited with the intention to carry out reforms in many of the departments covered by the multifarious activities of the Local Government Board; and he might make a worse beginning than by instituting a perfect system of audit in connection with municipal accounts. Only by this means will municipal trading be ever able to justify itself.

Entertainment and Presentation to Mr. R. Bruce Anderson.—On the 12th inst., the managers in Ireland connected with Mr. R. Bruce Anderson, of Westminster, in conjunction with the Westminster office staff, entertained Mr. Anderson at a complimentary dinner at the Palace Restaurant, in the Exhibition Grounds, Dublin, during which an illuminated address was presented to him by the managers associated with him prior to the foundation of the firm of Anderson Brothers. At the same function, opportunity was taken by the whole of the managers connected with the firm to present Mrs. Bruce and Mrs. G. W. Anderson each with an afternoon set of Belleek china.

Business Firms and Christmas Boxes.—A firm of cigar and wine shippers recently wrote to the Attorney-General, with a view of ascertaining the position of firms in reference to Christmas presents. They wrote: "We have been in the habit for many years past of giving Christmas presents of boxes of cigars to our customers or to their representatives. We shall be much obliged if you will advise us whether the giving of such presents is prohibited by the new Act." The Attorney-General replied saying that he cannot be taken as expressing an opinion, but "it is clear that Christmas presents which really have that character, and are openly and honestly given as such, cannot be within the Act."

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 528.)

THE Stock Exchange last week had a rather kalcidoscopic time of quick changes, which made it interesting, and was anyhow better than a run of unvariegated gloom. Certainly things might conceivably have been worse. The start looked bad enough for anything; for, under the influence of the previous Saturday's doings in Wall Street, the opening on Monday was very ill-omened, and Consols fell to 80¾—a hitherto unattained depth. But, rapidly recovering before the day was out, they actually left off at ¼ advance. On Tuesday, the better feeling made progress. Although the fortnightly settlement was pending, it was confidently believed to prove a light account and threatening no difficulties. A further rise of $\frac{7}{16}$ was marked in Consols; and Railways looked healthier. Wednesday started hopefully, with a careful eye in the direction of Wall Street. Some little buying was visible; but backers of a rise were soon satisfied, and then things fell flat, so that a good deal of the morning's gain was lost in the afternoon. However, the gilt-edged division were pretty firm. Again, on Thursday, under American influence, dulness prevailed; and this was emphasized by a rise in the Bank rate. Another quick change was witnessed on Friday, when, as the Wall Street horizon looked sunnier, the atmosphere cleared in Capel Court. But the brightness faded away before the day closed, and Consols and Rails relapsed. Saturday continued weak, and movements were almost wholly downwards; but absence of any hammering afforded some relief to the apprehensive. In the Money Market, there was a very good demand for short loans; but an abundant supply preserved rates from much movement. Discount rates, however, hardened steadily all through. On Thursday, the Bank of England rate was raised to 4½ per cent. Business in the Gas Market was very quiet; nothing, except the leading issue being dealt in to any extent. The general tendency was steady notwithstanding. In Gaslight and Coke, the ordinary was fairly active for the season, and prices were steady. Stock changed hands at from 94¾ to 95½ *cum div.*, and from 92½ to 93½ *ex div.* In the secured issues, the only transaction was one in the preference at 103¼ *ex div.* South Metropolitan was moderately dealt in at from 120½ to 121½ *cum div.*, and 118½ to 119½ *ex div.* The debenture marked 82½ and 81⅝—a fall of 1 in quotation. Nothing was done in Commercials but one bargain in the 3½ per cent. at 103. Little business was marked in the Suburban and Provincial group. Alliance old changed hands at 20, British at 42¼, Tottenham "B" at 102½, and West Ham at 102½. The Continental Companies were very inactive. Imperial was done at figures ranging from 173 to 175; but Union and European were not touched. Tuscan marked 10½ and 10⅝. Among the undertakings of the remoter world, Bombay new changed hands at $4\frac{15}{16}$, Buenos Ayres debenture at 94¼, Monte Video at 11⅛, Primitiva at 6⅞ and $6\frac{27}{32}$. ditto preference at 5, River Plate at from 12⅞ to 13⅛, ditto debenture at 94¼, and Oriental at 144.

ELECTRIC LIGHTING MEMORANDA.

Coveting the Prepayment Gas Business—The Commercial Weaknesses of the Mis-named "Free-Wiring" System—Its Feeble Support—Influence of Temperature on Incandescent Electric Lamps—Electric Plant Culture—Some Points on Illumination.

ELECTRICIANS are looking around for new sources of business; the new metallic filament lamp, with its consumption reducing power, being the *bête noire* of both their day and night dreams. The best they can do is to look once more over the wall at Naboth's new vineyard, and, seeing how good it is, raise again the question of "free-wiring" and slot meters. Mr. Nisbett re-introduced the matter in the "Electrical Times" lately; and his article was briefly discussed in the "Memoranda" on July 30. The design of his dissertation was to support the free-wiring and slot-meter plan of getting new business; and he gave some very good reasons why it should not be adopted, both from the electricity suppliers' point of view and that of the small electricity consumer. His opinion that in "free-wiring" and slot meters rests the salvation of the electricity industry, is countenanced by another correspondent in our contemporary. This correspondent believes that because there is profit in the prepayment business for gas undertakings, there is no reason why there should not be for electricity undertakings; and he also thinks that the reason there has been such "a number of electric installations which have gone back to gas" is to be found in ill-arranged fitting work, and the consequent waste of current. We have shown time after time that the working man with his limited income must, and will if he is prudent, have the utmost value for the money he spends, and the greater value for him lies with gas and not with electricity. Electricians are not going, as Mr. Nisbett opines they may be able to do, to cajole the working man into believing that five 8-candle incandescent electric lamps (which will not always give him 8 candles apiece) are sufficient to afford him a satisfactory illumination in his dwelling. The working man who is a desirable customer is not altogether devoid of sense. He will tell you flatly that he can do much better elsewhere, and that he can have, in addition to incandescent gas-lights, a cooking-stove always available, without any danger of failure in service, and at a great deal

less expense than anything the electrician can offer. Current-absorbing electric radiators, too, with their melancholy appearance and limited heating capacity, are not for such as he. The absurdity of Mr. Nisbett's proposal has already been exposed, as well as the calculated revenue of £1 11s. 3d. per annum per installation of five 8-candle power lights.

A great gulf exists between gas and electricity in the competition for the patronage of the working man. It is the electrician who has to bridge it; but he will not do it by losing money for his undertaking, or by trying to wheedle the working man into accepting as sufficient for him a rush-light illumination. Mr. G. Basil Barham (in the "Electrician") makes merry over the endeavour to re-energize the inanimate "free-wiring" business. He has seen the system tried and monetarily assisted in many places; he can count dozens of electricians who, having been fascinated by it, have, by experience, discovered its fallacies and unprofitableness. And he asserts, in unequivocal language, that no "free-wiring" scheme has yet been a financial success, and no such system that has been devised can ever become so. Its worst feature is in the superposing of additional cost upon an already costly system of lighting. The expression "free-wiring" is really a misnomer—"it is a maglignant misnomer, which perverts and distorts the imagination of those who fall a victim to its subtleties, until, with the coming of the first quarterly account, it rends the veil from the eyes of both consumer and station engineer, and fills the one with the fear of the Bankruptcy Court, and the other with the fear of assassination." Before the question of the cost to the working-man consumer stands, for the electricity suppliers, the cost of installation. Put what Mr. Barham has to say on this head against what Mr. Nisbett said. Mr. Barham states that the average number of lights installed in small houses of the class reached by "free-wiring" is twelve (not five); and the repayment of the cost of installation (which, with that number of points, would be about £7), at 20 per cent., spread over five years, would absorb 28s. per annum, while the interest and sinking fund on the cost of service mains, meters, &c., would total to another 5s. or 6s.—that is to say, 33s. or 34s. a year will be required from the consumer quite independent of his electricity consumption and lamp renewal bills. And this does not allow anything for maintenance. Mr. Nisbett's five 8-candle light installation is expected to produce a revenue of £1 11s. 3d. per annum at 3½d. per unit, *plus* 1½d. to cover the cost of installation. The £1 11s. 3d., at 5d. per unit, represents only 75 units; and 1½d. × 75 would produce the magnificent sum of 9s. 4½d. a year—always assuming the consumer after his first experience continues to use 75 units. This falls very short of Mr. Barham's estimate for a more reasonable installation than Mr. Nisbett's. If a rental system per lamp is adopted, 1s. per lamp for Mr. Barham's twelve lamps would only yield 12s. towards his 33s. or 34s.; 1s. 6d., 18s.; and rental of nearly 3s. per lamp must be charged the consumer to recoup the annual expenditure on this deceptive "free-wiring." Small wonder that Mr. Barham finds that "free-wiring" installations, instead of acting as passive canvassers for the electricity department, produce very active propagators of the dearness of electricity, and exposers of the delusive statements that induced them to become electricity consumers. At the advent of this system in a town, it is much easier to make installations than to make the branch pay after installation; and this is the reason why Mr. Barham can count dozens of engineers who have dabbled in such schemes, and have eventually renounced them as a drag on, rather than a support to, their undertakings. The prepayment gas system will stand long to smile at the puny attacks made by "free-wiring" and such-like.

Well, this "free-wiring" and fittings business does not gain a good word from anybody, excepting a few sanguine beings who entertain the opinion that anything is good enough for the working man's house in the way of equipment and illumination. From a financial standpoint, consulting engineers of the eminence of Sir Alexander Kennedy do not like the system, the Local Government Board do not like it, and the Lord Chairman of Committees is proposing to regulate the matter by the application of some model clauses between this and next session. The electrical contractors do not support free-wiring by municipalities, save on the one condition that the work is done through them and not the administrative authority.

The "Electrician" has published some notes on researches undertaken by MM. Laporte and Jouast, at the Laboratoire Central d'Electricité, on the influence of the surrounding temperature on the candle power of incandescent electric lamps. [M. Laporte contributed some valuable records of work on the standard flame lamps at the meeting of the International Photometric Committee, *ante*, p. 315.] We do not call to mind any experiments of the kind on incandescent gas-lamps; and these researches may suggest an investigation. In this case, an incandescent lamp, consuming about 4 watts per candle power, was fixed in a stove with a transparent side. A photometer was placed at a certain distance from the stove, and an equal illumination was obtained on its screen by moving the standard lamp. Great precautions were taken to maintain constant the voltage across the lamp terminals; a potentiometer being used for the purpose. In order that the variation of temperature should have no influence on the resistance of the contacts, both the main and the voltmeter wires were soldered direct to the lamp terminals. The candle power of, and the current through, the lamp were measured under the following conditions: (1) With the stove cold, at a temperature of about 15° C. (2) During the heating of the stove. (3) With the stove at a constant temperature of 115° C. (4) During the cooling of the stove. (5) With the stove completely re-cooled at a temperature of about 15° C. The candle-powers measured were found to be practically constant; the greatest variation between the extreme readings not exceeding 1 per cent. The current through the lamp was found to be constant to within 0·05 per cent. of its mean value. These results are interesting to note, as certain experimenters have observed a variation of 0·1 per cent. in the candle power of an incandescent lamp per degree variation of the surrounding temperature.

Mr. B. H. Thwaite is in the field again with what his enthusiastic nature no doubt prompts him to belive will really be a revolutionizing idea in the vegetable kingdom. The application of electricity to plant culture—on an experimental scale—is no new thing; but the game has not been found to be worth the electric light expended. Horticulturists and others interested in the matter have preferred more direct and less expensive means of stimulating growth. But Mr. Thwaite has a plan for economizing, by putting to the fullest use the products of electricity generation under his scheme; and a trial installation has found a place at the Royal Botanic Gardens. It is a system of many parts and purposes, and of suspected virtues—that is to say, "suspected" by its author. The necessary heat and actinic light as well as the carbon dioxide, moisture, and nitrogen fertilizer in the form of sulphate of ammonia, are to be derived from coal. "On the perfection of the combustion of the coal or fuel depends the entire economy of the system;" and this perfection can only be obtained by converting the carbon into a gaseous condition. A suction-gas plant and engine are to be employed, whereby perfect combustion is said to be attained simultaneously with the development of power, which is converted into electrical energy. The heat absorbed by the cooling water in the cylinder jacket is utilized for the purpose of heating the air in the glass-house by means of circulating-pipes; and the heat carried off in the exhaust gases is similarly employed by leading them, after purification by oxide of iron, through earthenware junction pipes into the glass-house, with outlets at suitable points, so that, at the same time, carbon dioxide, water vapour, oxygen, and nitrogen are supplied in a heated condition to the plants. The electrical energy generated is used for feeding arc lights. An electrostatic machine driven from the gas-engine shaft supplies energy which is discharged by points located along the plants; the object being the electrification, not only of the air of the glass-house, but of the plants and their roots as well. The arc lights are equipped with special reflector hoods, confining the beam of light within narrow limits of concentration; the open end of the hood is closed in with a water-screen, to secure as near an imitation of natural solar effect as possible, and to limit the effect of the ultra-red rays. The hood is provided with a chimney to carry off the nitrous oxides that may be produced. The arc lights are constantly and almost imperceptibly moved to and fro along the entire length of the glass-house by an electrical traveller. The particular attention of electricians is called to the fact that Mr. Thwaite is proposing to let the plants have the benefit of the exhaust gases of the gas-engine after purification merely in oxide of iron; but the hoods of the arc lights are to be provided with chimneys for carrying off the nitrous oxides.

In a paper, read a short time since, before the Glasgow section of the Institution of Electrical Engineers, Mr. J. D. Mackenzie devoted himself to the consideration of matters affecting illumination and illuminants. The main purpose of the commuuication was to sing the praise of lighting by reflection from walls and ceilings. It is a common belief that the indirect method of illumination is most wasteful; but Mr. Mackenzie quotes figures showing that, whereas 50 per cent. of the light given by an illuminant is lost by passing through opal globes, a whitewashed wall or ceiling will reflect light with only a loss of 20 per cent. It will hardly be credited that the carbon filament lamp can afford to lose 20 per cent. of its actual light in this way. Mr. Mackenzie says it is all right; but readers may reserve their own opinions on the subject. Of course, with indirect illumination, there must be double reflection—a direct reflection from reflectors placed behind the illuminants on to the ceiling, and then the diffused reflection from the latter, assisted by similar reflection from the walls and floors, gives the resultant illumination. But the author sticks to his opinion that, in actual practice, it will be found that the difference in efficiency of the two methods is not so great as many may think. Among other points of the paper is one that the eye can bear a greater amount of yellow aud orange tinted light than any other; and hence illumiuants giving off a preponderance of such rays seem to strain the eye much less than others. The author gives as an instance, the flame-arc light with its yellow and tinted light; and says that, although the intrinsic brilliancy of the lamp is much greater than that of the open arc, the eye can look upou it longer, and with less fatigue, than upon an ordinary arc lamp. This depends on the distance of the flame arc lamp; for however contented the eye may be with yellow and orange tinted light, it finds an agitated light, such as that produced by the composite chemical carbons of the flame arc, is extremely annoying. While Mr. Mackenzie says this good word for the flame arc, he declares that it is unfortunate for our eyesight, and that of the rising generation, that there is the present craze for increased illumination; the effect being seen in a most alarming increase of ophthalmic disease. He quotes as startling a remark of Mr. James Swinburne, that the new high-efficiency lamps will lead to consumers replacing their 16-candle lamps by

others of 25 to 50 candle power; and he urges that electrical engineers should strenuously endeavour to prevent such a calamity. That is not a nice way to talk of the new high-efficiency lamps—another of the hopes of the electricity industry. But it is found a little later on that Mr. Mackenzie advocates the placing of high-efficiency lamps, four in series on 200 to 250 volts, behind deep frieze mouldings, and having the light reflected from the ceilings. Consumers who are anxious to add to their expenses for electric lighting must be few and far between.

THE "CIRCULAR OF INQUIRY" AGAIN.

Following up our remarks from time to time on the attempts made to obtain information in regard to the management of gas undertakings by means of the obnoxious inquiry-circular, we have to call attention to the latest example (given below), which has reached us from more than one quarter. It can only be regarded as a move to get "on the cheap" information which should be procured, at an adequate fee, from a professional gas engineer. Such tactics are reprehensible when they are resorted to by members of small local authorities and others, who possibly wish to "get behind" their gas managers; but when an official of the standing of the American Consul at Liverpool—who it may be supposed is in a position (acting as he is doing on behalf of "a number of public-spirited citizens") to pay for the advice he requires—is found following their example, a stronger word is necessary to characterize the action.

American Consular Service.
Liverpool, Aug. 14, 1907.

Dear Sir,—A number of public-spirited citizens are about to instal a plant in an American city to sell gas at 60 c. (2s. 6d.) per 1000 cubic feet. The general conditions of the situation are briefly summarized in the enclosed statement. In fixing this price of 2s. 6d. per 1000 cubic feet, they are relying in great measure upon the basis established in many English cities. They have asked me to make inquiries to ascertain, if possible, if there are any important factors of difference between their situation and the conditions prevailing in your city which you think would make the success of their undertaking doubtful. In other words, they are desirous of knowing if you regard the price under their conditions as sufficient to reasonably promise a successful enterprise. I understand, of course, that whatever answer you might make would simply be a matter of opinion, and not to be regarded otherwise. As their undertaking is of great public interest, I thought you might be willing to give the subject a little of your valuable time. An expression of your views would be greatly appreciated.

Trusting that, in making this request, I am not imposing too great a burden on you,—I am, very truly yours,

(Signed) John L. Griffiths, Consul.

General Conditions Surrounding Proposed Gas Enterprise.

Interest to pay on investment, £15,000 per annum.
Company starts with 133 miles of mains.
Consumption on these lines, 400 million cubic feet per annum.
Estimate, 50 per cent. in lighting, 40 per cent. in cooking, 10 per cent. in power.
No fixed candle power required by law; but gas must be of 600 B.Th.U.
It is proposed to make 16-candle power gas, though not specified by the law.
Coal delivered at proposed works costs 10s. 5d. per ton, and produces 10,000 cubic feet of gas per ton.
Coke sells at 14s. to 16s. per ton at the works.
Ammonia concentrated liquor to be made; brings 20s. per ton.
Tar brings 7d. per gallon.
Prices to be charged for gas, 60 c. (2s. 6d.) per 1000 cubic feet for all uses.
No charges for meters, but consumer deposits 20s. on receiving a meter. Other appliances owned by consumer.
Cost of labour: Mechanics, carpenters, and gas-fitters, 12s. per day of eight hours; stokers 8s. and labourers 6s. per day of 12 hours.

Vertical Pipe Making.—According to the "Engineer," the vertical pipe-making plant imported by the South Australian Government is now under erection at Glanville. Pipes from 6 inches to 3 feet in diameter will be turned out, and the arrangement is such that the manufacture will form an uninterrupted series of operations from the first handling of the raw material to the final touches required on the finished pipe.

Electrolysis of Pipes.—The subject of the electrolysis of pipes is receiving careful attention from the Metropolitan Water and Sewerage Board of Massachusetts, who state in their last annual report that the districts in which such damage occurs seem to be extending. In general, the injury has not proceeded so far as to require immediate repairs; but the examinations show that the corrosive action is advancing. The pipe-lines crossing Chelsea Creek between Chelsea and East Boston were found to be particularly subject to disturbance; and at one point a hole had been eaten through a pipe. The examinations were carried out over the greater part of the system; records being taken of the conditions for future use in caring for the mains. Efforts are being made to devise means of checking the action of the current.

THE CENTENARY OF GAS LIGHTING.

(*Concluded from p.* 446.)

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This history of gas lighting would be incomplete were reference not made to the great strike at the South Metropolitan Gas-Works in 1888, and the introduction of the co-partnership scheme, and the threat of the gas stokers at this period to plunge London in darkness. The story of that great struggle is fresh in the memory of most men—how the brothers George and Frank Livesey withstood the demands of the strikers, and carried on the business.

In 1889, oil being cheap, an experiment in lighting the City streets with petroleum oil was carried out by the Defries Safety Lamp and Oil Company. The experiment lasted for a year; but nothing practical came of it.

Still, in the eighties, gas was being gradually displaced in the large buildings of the chief cities and towns, when an additional aid came to its rescue in the shape of a meter specially designed to fulfil the requirements of the working classes, and known as the automatic or penny-in-the-slot meter. This, together with the incandescent mantle and the increased popularity of the gas-cooker, saved the situation for the gas industry. Now was coming to pass the wish expressed, nearly a century ago, by Mr. Accum, that the dwellings of the working classes might be lighted by the "new illuminant;" for, strange as it may seem, the gas industry at this time had not succeeded in enlisting among its customers, to any large extent, the small householder, the tenant of two or three rooms, and the large number of inhabitants of blocks and artizans' dwellings. The workman preferred to burn oil and to cook by coal, to having to pay a quarterly gas bill, in addition to paying a deposit and signing an agreement at the offices of the company—which in his case meant very often a long journey, and loss of time and wages, in addition to his having to undergo the humiliating process of practically standing on the mat, with his hat in his hand, outside the inspector's room, for an indefinite period, and then being treated with scant courtesy when once admitted. Thus, with the electric light taking the richer customers, and the cheap oil holding the smaller ones, in 1892 the South Metropolitan Gas Company (who had 78,210 consumers on their books, with an annual increase of 1615 consumers, and 19,569 cooking stoves let on hire), began to turn their attention to new ground. Very few weekly tenants used gas; so that it could be taken as fairly correct to say that gas was practically unknown in the dwellings of the working classes. They would never, in addition to the reasons already given, incur the cost of putting in gas-fittings and pipes. Sir George Livesey, in his statement on slot-meters handed in to the House of Commons' Committee in 1899, said "this difficulty might have been overcome by monthly collections, if the demand had arisen, and the question of fittings could have been dealt with."

It is well to remember that slot-meters were first introduced into the Metropolis in 1888 by the South Metropolitan Company in a small way. But after their introduction, there seemed but little chance of their coming into general use; so that the 1888 experiment was dropped. Later on, in 1892, it became known that the Liverpool Gas Company had taken them up, and made them "go," having fixed some thousands. The meter was introduced to the Manager of the Liverpool Company; and he said, "I will try it." He ordered 500; and the thing "went like wildfire," and in a few months they had orders for 8000. "This fact," to use the words of the Chairman, "induced the South Metropolitan Company to go into the matter in earnest;" and before the end of the year, they had 439 fixed. By the end of 1893, the number was 6166; and during the next year, the total reached the respectable number of 25,516; and in 1898, 80,115. It was then seen that these meters had "come to stay;" and taking into consideration the competition of electric light among the well-to-do and business houses and cheap oil among the poorer classes, "it was sufficient," said Sir George Livesey, "to turn the scale in the annual output, and prevent any decrease in that direction." "We adopted the system of canvassing," said the South Metropolitan Chairman, "giving all our employees the option of doing this; and a certain bonus was given for each consumer they brought to the Company. We made no distinction—some were lamplighters, some index-takers, some gas-fitters, and some labourers. One man increased his annual income £46 by them. We gave them 2s. apiece. In fact, we thought we had nearly saturated the district with them, because when we started we estimated there were about 90,000 houses not burning gas. The increase was nearly 14,000 in 1896; only 9600 in 1897. But we tapped another source. We found there were a great many lodgers; and in 1897 we adopted a system of putting two or three meters in a house, and in 1898, the increase got up to 13,500." The Chairman might have added that a "roll of honour" for canvassers was fixed up at the entrance-gates of the yards giving the men's names, the weekly number of customers brought in, the total number of consumers gained, and the amount of money earned; so that a keen spirit of rivalry was set up among the workmen to go out and fetch would-be consumers in. So popular did the prepayment meters become with the tenement class, that at the end of 1906 there were some hundreds of thousands in use in the Metropolis alone; and as a small cooker and a ring were loaned out with each

meter, it very materially assisted in keeping the works manager and engineer busy. To give an idea of the growth of this business, Bristol might be cited as having in 1902 twenty coin-freed meters; while the number they had out in 1906 was 16,157. The large cookers for ordinary consumers were also becoming much sought after; and builders, in erecting new houses, made provision for fixing them. In 1906, to mention only two instances, the South Metropolitan Company had no less than 267,000 gas cookers and fires of all kinds in use; while the Gaslight and Coke Company issued during the same period 110,000 additional cookers —giving them a net increase for that year of 57,000 on this class of goods. To regulate the price of gas to consumers using prepayment meters, Parliament in 1900 fixed it at 10d. per 1000 cubic feet above the ordinary price, to cover cost of fitting and hire.

It would be incorrect not to mention the great gas inquiry held in 1899 by Parliament, in answer to the agitations all over the Northern Metropolis in favour of cheaper gas. The voluminous evidence is still fresh in the minds of all gas engineers. The inquiry continued during the whole length of the session; and the findings of the Committee, which were against the Gaslight and Coke Company, foreshadowed a reduction in the standard price, a lowering of the candle power, and a restriction of future capital powers when any of the Companies came to Parliament. These effects were made operative upon the South Metropolitan Company in 1900, the Commercial Company in 1902, and the Gaslight and Coke Company in 1903. The illuminating power of the first two Companies was reduced from 16 to 14 candles; and the standard price and the statutory dividend of all the Companies were lowered.

In 1905—the use of high-pressure gas for the heating of incandescent mantles having been satisfactorily tested for about five years in the busiest portions of the City and on the principal bridges spanning the Thames—an extended experiment to several of the most important thoroughfares was carried out; the gas being supplied direct from the high-pressure mains of the Gaslight and Coke Company in some cases, and by compressing plants in others. So successful was the experiment, and so well did the public take to it, that it was decided gas-lamps should remain on the removal of the arc columns from the City, from Paddington, and elsewhere, after their thirteen years' existence—a striking testimony to the efficiency of gas-lamps for lighting the busiest thoroughfares of our great cities. Islington followed later on. Strangely enough, at the very time that the experiment had been deemed by the authorities to be a success as a piece of main road lighting, Sir William Preece, in 1905, true to the opinions he held over twenty years previously, speaking at a meeting of the Carnarvon Harbour Trust, when the proposed installation of the electric light on the promenade was under discussion, strongly urged the Trustees to have the promenade lighted by incandescent gas mantles, which, he said, distributed the light much better than electric lamps. He added that he always recommended public authorities to use them in preference to electricity as an illuminant for public thoroughfares. This well-established fact, and the introduction of the inverted burner for indoor and general domestic lighting as a rival to the incandescent electric lamp, gave a great impetus to the gas industry, and more than helped it to hold its own against its once formidable rival.

Passing to another subject of great importance that took place about this time—viz., the legislation with regard to sulphur compounds (that bogey to the gas manager which had caused so much feeling in the late fifties and sixties), which freed the gas industry from harsh restrictions that barred its advancement—it is of interest to note the effect of such freedom upon the Gaslight and Coke Company, whose works' cost for 1906 had been reduced by some £14,000 in purification. This service rendered to the gas industry by Sir George Livesey (for it was he who initiated the legislation), caused Mr. Charles Hunt, referring to the matter recently, to speak of the author of this legislative enactment in the following strain: "The indomitable pluck, perseverance, and tactical skill with which he fought the fight to a finish . . . But for him, it is impossible to say how much longer the industry would have had to labour under the double disadvantage of compulsory lime purification and high illuminating power. But for him, our progress must have been halting and unsatisfactory. It matters not that the battle fought was that of the London Gas Companies, the victory remains with the gas industry as a whole. A momentous step forward has been accomplished; and the gas manager may henceforth devote his time and energies to more profitable use than watching for fluctuations of a few grains of sulphur compounds, or for rushlight changes of candle power." A worthy tribute to the man who, from the year 1848, has devoted himself to the benefit and advancement of the gas industry of the United Kingdom.

It is only fitting here to pay tribute to Mr. Charles Carpenter, who had produced a burner for testing gas which was to at last displace the "old brass burner" and the Sugg argand, both of which had done duty between them for 70 or 80 years. The burner was fully described by Mr. Carpenter in his paper before the Institution of Gas Engineers in 1906, and might be fittingly termed the bringing to a close of one of the chapters in the modern history of gas lighting, so far as testing and public control are concerned, for under the provisions of the London Gas Act, 1905, the Metropolitan No. 2 burner, which is Mr. Carpenter's invention, was adopted by the Metropolitan Gas Referees, and is becoming the prescribed burner for testing gas at a fixed rate of consumption in the modern Gas Acts of the country.

In conclusion, it is instructive to have an idea of the enormous demand for gas for purposes of lighting, cooking, heating, and power at this period of gas history, given by Mr. Charles Hunt in his recent Presidential Address to the Institution of Gas Engineers. "During 1882," he remarks, "the consumption of gas within the United Kingdom was in round figures 57,876 million cubic feet, and the number of consumers 1,971,971. For the year 1905 (23 years after), the consumption was 161,408 million cubic feet, with 5,064,175 consumers." This shows a remarkable growth from the period of the introduction of the electric light.

The following table gives the increases for 23 years in capital, consumption, consumers, and number of public lamps, with the increases.

—	1882.	1905.	Increase.
Capital invested . .	£50,261,118	£124,184,221	£73,923,103
Consumption . . .	57,876 millions	161,408 millions	103,532 millions
Consumers	1,971,971	5,064,175	3,092,204
Public lamps . . .	361,311	665,791	304,480

A few individual cases of increase set out in the following table are interesting.

Town.	1882. Consumption.	1905. Consumption.	Increase.
Glasgow	1,795 millions	5,821 millions	224 per cent
Birmingham	2,692 ,,	6,463 ,,	140 ,,
Leicester	612 ,,	1,835 ,,	200 ,,
South Metropolitan Company	3,822 ,,	12,143 ,,	217 ,,

The consumption of coal by the gas companies for the United Kingdom stands at 15 million tons, of which the principal London companies take no less than 3 million tons.

These are truly remarkable figures with which to bring to a close the story of the rise, progress, and centenary of the gas industry of the United Kingdom.

The attached table gives the price of gas in London from 1823 to July 1, 1907. Previous to 1823, a considerable portion was sold by "rental."

TABLE *of Prices Charged for London Gas from* 1823 *to July* 1, 1907.

Date.	Price per 1000 Cub. Ft.	Date.	Price per 1000 Cub. Ft.	Date.	Price per 1000 Cub. Ft.
	s. d.		s. d.		s. d.
1823	15 0	1854	4 0	1885	2 8
1824	15 0	1855	4 0	1886	2 6
1825	15 0	1856	4 0	1887	2 5¼ aver.
1826	15 0	1857	4 0	1888	2 5
1827	15 0	1858	4 0	1889	2 3
1828	13 6	1859	4 0	1890	2 3
1829	13 6	1860	4 6	1891	2 3¾
1830	13 6	1861	4 6	1892	2 6
1831	12 6	1862	4 6	1893	2 5¼ aver.
1832	12 6	1863	4 6	1894	2 4½ ,,
1833	11 3	1864	4 6	1895	2 3½
1834	10 0	1865	4 6	1896	2 3
1835	10 0	1866	4 6	1897	2 3
1836	9 6	1867	4 6	1898	2 3
1837	9 0	1868*	3 3	1899	2 2
1838	9 0	1869	3 3		2 1
1839	9 0	1870	3 2	1900	2 1
1840	9 0	1871	3 1		2 4
1841	9 0	1872	3 0		2 8
1842	9 0	1873	3 0	1901	2 8
1843	8 0	1874	3 0		2 3
1844	7 6	1875	3 0	1902	2 3
1845	7 0	1876	3 6†	1903	2 3
1846	7 0	1877	3 2	1904	2 1
1847	6 6	1878	3 0		2 0
1848	6 0	1879	3 0	1905	2 0
1849	5 6	1880	3 0	1906	2 0
1850	4 0	1881	2 10	Jan. 1, 1907	2 0
1851	4 0	1882	2 10		
1852	4 0	1883	2 10	July 1, 1907	2 3
1853	4 0	1884	2 8		

* From 1868 the South Metropolitan Company's prices are quoted, theirs being the lowest.

† Average for the year, 3s. 0½d.

Notes.—1810. "Gas rental" charged, competition.
1823 to 1848. Agreed areas, "Congreve compact" of 1823.
1848 to 1860. Competition.
1860 to 1868. Districting.
1868 to 1883. Amalgamations.
1883 to 1907. Statutory monopoly.
1894. From this date, meter-rents were waived by the Gaslight and Coke Company, who, however, reimposed them at Midsummer 1907. They equalled ¾d. per 1000 cubic feet.

This history throughout has been but a chronicle of facts, and in no way reflects the opinions of the writer, who, however, takes this opportunity of stating his belief that—given cheap gas supplied at a higher pressure than formerly, of a low illuminating power, and of high calorific value to meet the altered circumstances and the new demand—there is no finality for the purposes and uses for which gas can be employed during the coming century.

PHOTOMETRIC TESTS, BY MR. THOMAS GLOVER, OF INVERTED BURNERS.

THE report in the "JOURNAL" of the 23rd ult. (p. 224), on the proceedings of the International Photometric Committee at Zurich, contained a summary of remarks made by Mr. James W. Helps, of Croydon, on the methods in use in England for measuring the light of incandescent gas-burners. Mr. Helps incidentally quoted some figures, which he said had been communicated to him by another gas engineer, to indicate the importance of angular readings being made in photometric testings of inverted burners. At the time, however, Mr. Helps was (our correspondent understood) uncertain as to whether he had his informant's authority to make them known in their entirety or to name their source; and, therefore, he only quoted a few figures from the communication in support of his general observations. The figures were given in the "JOURNAL" report. Mr. Helps has since, however, obtained authority to communicate the full results of the testings, which were sent to him by Mr. Thomas Glover, of Norwich; and we have pleasure in reproducing them below. The actual names of the burners are here suppressed, by desire; but the figures are nevertheless highly instructive, and Mr. Glover deserves many thanks for communicating them.

"A" *Inverted Burner* (*Large*).

WORKING CONDITIONS.

Globe Used.—None.
Gas Used.—Mixture of 70 per cent. coal gas and 30 per cent. water gas.
Illuminating Value of Gas Used.—15·80 candles.
Air Supply.—Air-ports full open.

Angle Tested at.	Pressure of Gas. Inches.	Gas Consumed. Cubic Feet per Hour.	Candle Power of Burner.	Efficiency. Candles per Cubic Foot.
0°	2·5	3·5	58·5	16·7
12°	2·5	3·5	55·3	15·8
30°	2·5	3·5	62·5	17·8
40°	2·5	3·5	63 4	18·1
60°	2·5	3·5	69·8	19·7
70°	2·5	3·5	70·0	20 0
80°	2·5	3·5	82·1	23·4
90°	2·5	3·5	100·6	28·7

"A" *Inverted Burner* (*Small*).

WORKING CONDITIONS.

Globe Used.—Clear glass with hole in base.
Gas Used.—Mixture of 70 per cent. coal gas and 30 per cent. water gas.
Illuminating Value of Gas Used.— 15·59 candles.
Air Supply.—Air-ports full open.

Angle Tested at.	Pressure o. Gas. Inches.	Gas Consumed. Cubic Feet per Hour.	Candle Power of Burner.	Efficiency. Candles per Cubic Foot.
0°	2·5	1·65	21·5	13·0
12°	2·5	1·65	19·3	11·7
30°	2·5	1·65	23·1	14·0
40°	2·5	1·65	24·5	14·8
60°	2·5	1·65	29·1	17·6
70°	2·5	1·65	30·6	18·5
80°	2·5	1·65	36·6	22·1
90°	2·5	1·65	41·6	25·2

"B" *Inverted Burner* (*Large*).

WORKING CONDITIONS.

Globe Used.—None.
Gas Used.—Mixture of 70 per cent. coal gas and 30 per cent. water gas.
Illuminating Value of Gas Used.—15·59 candles.
Air Supply.—Air-ports half closed.

Angle Tested at.	Pressure of Gas. Inches.	Gas Consumed. Cubic Feet per Hour.	Candle Power of Burner.	Efficiency. Candles per Cubic Foot.
0°	2·0	3·5	48·7	13·9
10°	2·0	3·5	45·5	13·0
20°	2·0	3·5	45·5	13·0
30°	2·0	3·5	48·7	13·9
40°	2·0	3·5	58·1	16·6
60°	2 0	3·5	65·6	18·7
70°	2·0	3·5	75·6	21·6
80°	2·0	3 5	78·8	22·5
90°	2·0	3·5	90·0	25·7

"B" *Inverted Burner* (*Small*).

WORKING CONDITIONS.

Globe Used.—Clear glass.
Gas Used.—Mixture of 70 per cent. coal gas and 30 per cent. carburetted water was.
Illuminating Value of Gas Used.—15·59 candles.
Air Supply.—Air-ports half open.

Angle Tested at.	Pressure of Gas. Inches.	Gas Consumed. Cubic Feet per Hour.	Candle Power of Burner.	Efficiency. Candles per Cubic Foot.
0°	2·0	1·5	18·5	12·3
10°	2·0	1·5	18·4	12·3
20°	2·0	1·5	18·4	12·3
30°	2·0	1·5	21·0	14·0
40°	2·0	1·5	21·9	14·6
60°	2·0	1·5	27·3	18·2
70°	2·0	1·5	34·4	22·9
80°	2·0	1·5	36·3	24·2
90°	2·0	1·5	38·2	25·2

"C" *Inverted Burner.*

WORKING CONDITIONS.

Globe Used.—None.
Gas Used.—Mixture of 70 per cent. coal gas and 30 per cent. carburetted water gas.
Illuminating Value of Gas Used.—15·59 candles.
Air Supply.—Air-ports full open.

Angle Tested at.	Pressure of Gas. Inches.	Gas Consumed. Cubic Feet per Hour.	Candle Power of Burner.	Efficiency. Candles per Cubic Foot.
0°	2·4	3·7	55·3	14·9
10°	2·4	3·7	50·6	13·7
20°	2·4	3·7	51·2	13·8
30°	2·4	3·7	62·5	16·9
40°	2·4	3·7	62·5	16·9
60°	2·4	3·7	73·5	19·8
70°	2·4	3·7	84 1	22·7
80°	2·4	3·7	92·8	25·1
90°	2·4	3·7	117·8	31·8

OPERATING CARBURETTED WATER-GAS PLANTS.

[COMMUNICATED.]

THE details of carburetted water gas manufacture are a subject of great importance, now that it is made in such large quantities in this country. Comparative figures in connection with this branch of gas manufacture are conspicuous by their absence. This is much to be regretted, as managers who are anxious to obtain the best of results cannot procure any information as to the comparative merits of their own and their neighbour's working. "Field's Analysis" and other statistics not only entirely omit comparative figures in this branch of gas manufacture, but make the mistake of inserting them in conjunction with the figures for coal gas, with the result that these also become most misleading. One has only to compare the figures of the South Metropolitan Gas Company, who do not make water gas, with those of the Gaslight and Coke or any other large company who do, to observe how much they differ. It is only when papers are read at the meetings of the different Associations that one is able to glean any information as to the consumption of coke or oil in the making of carburetted water gas.

No one will deny that carburetted water-gas plant is a very useful adjunct in any works; and though few will be found to express the opinion that these plants actually produce gas more cheaply than coal-gas plant, yet it appears to the writer that if advantage be taken of the economical working of a Dellwik or a Kramers and Aarts generator to be used with a Lowe carburettor and superheater, the result would be infinitely more satisfactory than the use of a complete Lowe plant. Times have changed, and now it is quite usual to make carburetted water gas of a lower quality (both in illuminating and in calorific power) than coal gas. Thus it is not unusual for a Lowe water-gas plant to be found working with a consumption of oil about half that for which it was originally intended. It cannot, under these conditions, be expected that the plant will work so economically when making 14-candle gas as it did when making 28-candle gas. In producing the higher quality of gas, a larger proportion of the waste heat is used to vaporize the greater quantity of oil. With the consumption of a small quantity of oil, only a fraction of the waste heat is used; and thus the consumption of coke is proportionately heavy.

In Bryan Donkin's "Gas, Oil, and Air Engines," it is stated that the quantity of producer gas made in maintaiuing the fuel at a proper working heat exceeds the quantity of water gas by no less than four times. The question naturally arises as to how much of this gas is needed to maintain the carburettor and superheater at a proper heat. As an instance, take the case of a plant using 2 gallons of oil per 1000 cubic feet. In this case the illuminating power of the gas would be (say) from 14 to 15 candles. For gas of this quality only a small proportion of the generator gas is required to maintain the carburettor and superheater at a temperature suitable for vaporizing the oil.

The writer recently made some experiments with a Lowe water-gas plant, to ascertain just what quantity of the generator gas is actually needed for this purpose, and to ascertain whether economy would not result from an alteration of the usual methods adopted in working these plants. It is customary to maintain the fuel at a depth of about 9 feet; but this has certain disadvantages. In the first place, it needs a long blast for the proper maintenance of the heat; and, secondly, the percentage of carbon monoxide is higher than if a shallow bed of fuel is being used. It is well known that in burning carbon to carbon monoxide the

resulting heat is only a fraction of that caused by the complete combustion of carbon to carbon dioxide. To give actual figures, in burning 1 lb. of carbon to carbon monoxide, 2400 calories are liberated; while in burning the same quantity of carbon to carbon dioxide, 8080 calories are liberated—a quantity 3·3 times greater. Therefore for the economical heating of the generator fuel bed it is most important that as much as possible of the carbon should be burnt to carbon dioxide.

A reduction in the depth of the fuel brings about an appreciable increase in the percentage of carbon dioxide produced in the "blow," enabling its duration to be shortened by a full minute or more, and thus saving the consumption of coke. While carbon dioxide is being produced in greater quantities than carbon monoxide, the loss of heat is not very excessive; but as soon as the quantity of carbon monoxide becomes greater, the loss is very considerable. With a 7-feet fuel bed, the following test illustrates the force of this argument:—

Composition of "Generator" Gas during the "Blow."

	Per Cent. CO_2.	Per Cent. CO.
1st minute of "blow"	15·2 ..	5·0
2nd ,, ,, ...	13·0 ..	7·4
3rd ,, ,, ...	7·0 ..	13·4

If the blast were maintained during the fourth minute, the gas would consist almost entirely of carbon monoxide. Some further tests were taken of the gases on the outlet of the superheater after the supply of secondary air had been admitted in the carburettor, with the object of ascertaining the quantity of carbon monoxide required for the maintenance of the carburettor and superheater at the required temperature. In most cases it was found that a mere fraction, averaging about 1 per cent. of carbon monoxide, in addition to the hot waste gases (CO_2), was needed for this purpose; showing plainly that only a very small proportion of the producer gas is utilized in this manner. The result of these few experiments convinced the writer that a system in which carbon dioxide only is produced in the generator during the "blow" would be infinitely more economical for working in conjunction with a Lowe carburettor and superheater.

It is well known that in the Dellwik system the air-blast is admitted at high pressure, being at least double that used with the Lowe plant; while the depth of fuel is much shallower. By this means the duration of the blast is prolonged for about a minute only, instead of for three or four minutes, as with the Lowe plant. Thus it is possible in the Dellwik system to make 1000 cubic feet of gas with from 25 to 30 lbs. of coke, while with a Lowe plant a quantity of from 40 to 45 lbs. must be used.

To revert to the experiments above mentioned, it was found that by reducing the depth of the fuel from 9 feet to 6 feet, it was possible to shorten the "blow" by one minute—from 4 to 3 minutes—without altering the length of the "run." This resulted in a saving of about 4 or 5 lbs. of coke per 1000 cubic feet of gas, and also increased the capacity of the plant to an appreciable extent. At one time a fuel bed of 5 feet in depth and an air-blast of two minutes only, to correspond with a "run" of five minutes, were being worked; but it was found that this method of working was not altogether satisfactory. These alterations did not, as might have been expected, increase the quantity of carbon dioxide in the water gas. The writer is quite well aware that the combination of a Dellwik generator and a Lowe carburettor and superheater is not an original idea; but the preceding few points are mentioned to draw attention to a system which is worthy of adoption.

Since the foregoing observations were written, the writer has perused the description of the water-gas plant at Trieste given in the "JOURNAL" for April 10, 1906 (p. 111). Here was adopted a combination of the Dellwik generator and the Lowe carburettor and superheater. Arrangements were also made to enrich the blue water gas by the use of benzol if preferred. A series of trials were made—first with the manufacture of water gas alone, and then with water gas carburetted with a petroleum oil. In the latter test, 2·6 gallons of oil were used with a consumption of 33·8 lbs. of coke per 1000 cubic feet of gas. This result is greatly superior to that obtained with the Lowe plants, and quite bears out the anticipations of the writer when making the few tests he has described. This saving in the consumption of coke would represent an amount approximating to 1d. per 1000 cubic feet on that obtained in the Lowe plants, increasing at the same time the capacity of these plants to a very considerable extent.

"Erginis" is a liquid fuel which has found much application in Germany. According to the "Engineer," it is obtained from tar by a secret process, and is reported to have a heating power of 16,500 B.Th.U. per pound.

At a recent meeting of the Paris Academy of Sciences, the subject of the heat of combustion and formation of gaseous hydrogen phosphide was dealt with by M. Lemoult. The measurement has hitherto been made by indirect methods only. The author has carried out direct measurements by exploding hydrogen phosphide with oxygen in the calorimetric bomb. Observations were made with a Mahler enamel-lined bomb and with a Berthelot platinum-lined bomb; and the results agreed within about 0·5 per cent. The molecular heat of combustion of phosphoretted hydrogen is 310 calories at constant volume, and 311·2 calories at constant pressure.

THE MUNICH CARBONIZING CHAMBERS.

(*Continued from p.* 440.)

Report by Dr. H. Bunte on the Investigation of the Working of the Settings by the Instructional and Experimental Gas-Works of the German Association of Gas and Water Engineers.

THE report is dated June 1, 1907; and is addressed from Carlsruhe to the Management of the Municipal Gas-Works of Munich. It is a lengthy document; but all the more important portions are abstracted in the following summary of its contents.

The investigation was suggested to Dr. Bunte by Herr Ries, the Manager of the Munich gas undertaking, and was willingly undertaken, because of the specially interesting characteristics of the new system of chamber carbonizers. It was carried out under Dr. Bunte's direction by Dr. Henseling, the Assistant-Engineer of the Instructional and Experimental Works, and Herr Zschimmer, the Chemist to the Bavarian Inspection Union at Munich, with the assistance of Herr Rauch, the Works Assistant, and Dr. Schumann, the Chemist of the Munich Gas-Works. The investigation was made from the 7th to the 16th February last, and a large number and variety of observations were made, the import of some of which has not yet been ascertained. The present report is, therefore, only preliminary.

The report refers first to the changes which recent years have witnessed in the construction of gas-retort settiugs, with a view to facilitating charging and discharging, and to relieving the stokers. But the inclined retorts introduced with these objects are, it states, of similar size to the older retorts, and do not offer any solution of the problem, which becomes more imperative with the increase in the size of gas-works, of the manipulation of such a large number of relatively small vessels. The coke-oven could not be forthwith transplanted into gas-works, because it was not adapted to the condition which prevails there, of being able to accommodate its output to the variations in the consumption of gas. The first successful attempt to adapt coke-oven practice to gas-works conditions has been made at the Munich Gas-Works. But the changes which have taken place of late years in the mode of using gas for lighting, and the increase in its use for heating purposes, have primarily facilitated the development of gas manufacture in the direction just referred to. The quality of gas must now be judged by its calorific power; and if its illuminating power in a flat-flame or argand burner is still ascertained, no considerable importance need be attached to its properties in that respect. There is no generally accepted standard of calorific power; but the following are the average values for the last two years for the gas supplied in certain large towns.

Gross Calorific Power.

— —	Calories per Cubic Metre at 0° C. and 760 mm.	B.Th.U. per Cubic Foot at 60° Fahr. and 30 inches.
Berlin	5400	574
Magdeburg	5090	541
Bonn	5288	562
Breslau	5433	578

It thus appears that, generally, gas of an average gross calorific power of 5000 to 5500 calories per cubic metre (532 to 585 B.Th.U. per cubic foot at 60° Fahr. and 30 inches) is considered a satisfactory product; and the gas made by the Munich chamber settings has been valued according to such a standard.

Passing on to the actual investigation, the report states that seven tests, each of 24 hours duration, were conducted between Feb. 7 and 16 last. One series of tests, from Feb. 7 to 11, aimed at following the course of the distillation of the coal in detail and the changes in the quality of the gas. The nine chambers were therefore charged as nearly as possible at the same time, and all discharged at the end of 24 hours. A second series of tests, made from Feb. 13 to 16, aimed at studying the duty of the settings in continuous work; and the chambers were therefore charged and discharged one after the other as in ordinary working. A mixed gas was thus obtained; whereas in the first series the chambers acted as one large chamber, and the changes in the quality of the gas in the course of the 24 hours' working off of the charge were clearly exhibited.

The coal used was "Heinitz I," a Saar coal of normal character, having the following average composition: Moisture 2·4 per cent., ash 7·1 per cent., and coal proper 90·5 per cent. The coal proper consisted of: Carbon 85·02 per cent., hydrogen 5·38 per cent., oxygen 7·28 per cent., nitrogen 1·22 per cent., and sulphur 1·10 per cent. The moisture in the coal ranged from 2·22 to 2·56 per cent. on the different days of the trials, and the ash from 5·55 to 8·44 per cent. The calorific value of a sample of the coal containing 6·27 per cent. of ash and 1·98 per cent. of moisture was 7415 calories per kilo. (13,347 B.Th.U. per lb.).

The general results of the trials were given in the "JOURNAL" for June 18 (p. 810); but the annexed table, prepared from the tables in the report, gives further particulars—see p. 502.

The coke used for heating the settings was from Saar coal, and a sample of that used on the 8th and 9th of February contained 8·68 per cent. of ash and 7·73 per cent. of moisture, and had a

Trials with Saar Coal of Three Settings, each Containing Three Chambers.

—	Individual Trials, each of 24 Hours Duration.							Average per 24 Hours.	Absolute Totals. Average per 24 Hours.
	Chambers Charged Simultaneously.				Chambers Charged as in Ordinary Running.				
1907, February	7-8.	8-9.	9-10.	10-11.	13-14.	14-15.	15-16.		
Coal carbonized	..	..	..	..	..	..	..	..	452¾ cwt.
Coke (dry) used for heating; per cent. of weight of coal	14·83	16·37	16·06	16·31	14·05	14·55	15·07	15·32	69½ ,,
Average temperature of setting; degrees Fahrenheit	2,269	2,318	2,260	2,178	2,385	2,277	2,313	2,286	..
Make of gas; cubic feet per ton, at 0°C. and 760 mm	11,131	11,027	10,848	10,748	10,232	10,593	10,550	10,733	242,590 cb. ft.
,, ,, ,, ,, ,, ,, 60° Fahr. and 30 inches	11,762	11,652	11,463	11,357	10,814	11,194	11,148	11,342	256,345 ,,
,, ,, per cent. of weight of coal	16·44	16·59	15·11	15·87	13·97	15·35	15·29	15·55	69¾ cwt.
Gas—									
Specific gravity	0·41	0·41	0·38	0·41	0·38	0·40	0·40	0·40	..
Illuminating power in slit burner; Hefners per 150 litres (5·3 cb. ft.) at 0°C. and 760 mm	11·59	10·94	11·23	12·59	12·22	12·41	12·17	11·88	..
Illuminating power in slit burner; candles per 5 cb. ft. at 60° Fahr. and 30 inches	9·41	8·88	9·12	10·22	9·92	10·08	9·88	9·65	..
Calorific power; gross, calories per cubic metre at 0°C. and 760 mm	5,870	5,769	5,837	5,936	5,916	5,938	5,946	5,887	..
Calorific power; gross, B.Th.U. per cubic foot at 60° Fahr. and 30 inches	624	613	621	631	629	631	632	626	..
Coke obtained (dry); per cent. of weight of coal	67·88	66·17	67·71	63·97	67·01	68·19	66·57	66·77	303 cwt.
Tar and liquor; ,, ,, ,,	13·63	12·82	13·04	13·04	14·71	13·66	13·16	13·44	61½ ,,

calorific value in that state of 11,928 B.Th.U. per lb., or in the dried state of 12,890 B.Th.U. per lb. The heating of the settings was checked by tests at short intervals. The products of combustion in the flues had a uniform composition; showing on the average 18 per cent. of carbonic acid and about 2 per cent. of oxygen. The temperature was observed with the Wanner pyrometer at many places, both at the charging and discharging ends and on the right and left of the chambers; and, with small fluctuations, it averaged about 1250°C., or (say) 2280° Fahr. The mean temperature in the individual trials is shown in the table. It was found that any attempt to reduce the degree of heating towards the close of carbonization disturbed the working of the settings. The coke consumption for heating the settings was carefully checked by weighing throughout; the moisture in the coke used being determined so that the results could be recorded on a uniform (dry) basis. The consumption shown in the table for the second series of trials, when the chambers were charged as in ordinary working, more nearly represents the normal consumption of the settings, as in the first series some of the retorts remained empty for a time between discharging and re-charging. The average consumption of coke (dry) in the producers in the second series of trials was 14·56 per cent. of the weight of coal carbonized. The coke was used cold; whereas in ordinary practice results more favourable (by, say, a 5 per cent. diminution) would be obtained through the use of hot coke.

Special arrangements were made for ascertaining exactly the quantity and quality of the gas made. A special train of apparatus was cut off from the rest of the plant at the Kirchstein works (where the chamber-settings are) at Munich, and two station meters, which had been carefully rated immediately before, were used for measuring the gas made. A 1½-inch branch led a stream of purified gas from the outlet of the meters to a well-ventilated photometer room, where half-hourly determinations were made of specific gravity, illuminating power, and calorific value. Samples of the gas were taken every hour and sealed in glass tubes for subsequent examination. The make of gas is shown in the table, and is considered high for Saar coal even of the best quality. The coke appeared very thoroughly exhausted of gas. The gas was treated and purified in the usual manner. The quality of the gas, as indicated by the calorific power and illuminating power shown in the table, is considered as quite normal or good. The specific gravity of the gas was taken for the purpose of calculating the weight of gas made—not as a criterion of quality.

The yield of coke is shown in the table; and its composition has been indicated in connection with what has already been said in regard to the coke used for heating the settings. Its appearance was characteristic, and quite indicative of the density, hardness, and structure of foundry coke. This indication was borne out in the sorting of the coke, 100 parts of which yielded on the average 92·2 per cent. of large coke, 1·4 per cent. of medium, 3·8 per cent. of small, and 2·6 per cent. of fine breeze. The tar and liquor produced were collected and weighed at regular intervals, and on the average amounted to 13·44 per cent. of the weight of coal carbonized. On separation, 6·14 per cent. proved to be crude tar, and 7·30 per cent. liquor. The tar appeared to be normal in character. The liquor contained on the average 2 per cent. of ammonia; so that there was a yield of 0·211 per cent. of ammonia (0·82 per cent. of sulphate) on the weight of coal carbonized. This is equivalent to 4·73 lbs. of ammonia or 18·35 lbs. of sulphate per ton of coal. This yield is considered very high for Saar coal. The yield of ammonia from this coal in the ordinary retort-settings is 0·135 per cent. of the weight of the coal. This indicates that the chambers give about a 50 per cent. greater yield of ammonia than ordinary retorts.

The Course of Carbonization in the Chambers.

The course of gas production during the period of 24 hours' carbonization in the chambers is quite characteristic. These chambers take a charge 8 to 16 times the weight of that of an ordinary gas-retort; and 24 hours are allowed for working off, in place of four or five hours. The influence of this change of conditions on the nature and quantity of the products had therefore to be ascertained. The results of the observations made were plotted out on diagrams; and it appeared therefrom that the conditions were practically identical in all the trials, so that the first day's trial may be taken as typical, and used for a general consideration of the course of distillation in the chambers.

Gas Production.—Immediately after charging, the rate of production of gas attains its maximum, which, however, does not greatly exceed the average. It falls off in the course of the first three or four hours to a tolerably uniform mean rate, and decreases only gradually up to the end of 17 hours. From 18 hours the production shows a rapid falling off, and practically comes to an end at 24 hours.

Illuminating Power.—The illuminating power, measured in a slit-burner at the rate of 150 litres at 0° C. and 760 mm. (5·6 cubic feet at 60° Fahr. and 30 inches) per hour, rises in the first hour to a maximum of about 24¾ candles (per 5 cubic feet, corrected), falls sharply to about 14½ candles at the end of the second hour, and then more gradually to 12·2 and 10·5 candles at the close of the third and fourth hours. It then remains fairly uniform to the end of the twelfth hour, whence it falls off at a fairly regular rate to about 4·9 candles at the close of the seventeenth hour. The fall continues till at the end of the period of distillation the illuminating power becomes practically *nil*.

Calorific Power.—The calorific power is more constant, owing to the greater persistence in the gas made of methane, to which it is largely due, than of ethylene, which is the chief source of the illuminating power. In the first hour a maximum value (gross) of about 890 B.Th.U. per cubic foot (at 60° Fahr. and 30 inches) is attained; and there is then a gradual fall to 640 B.Th.U. at five to six hours. The value remains virtually constant until eleven hours, when a very gradual fall sets in, and continues tolerably uniformly to the close of the period of carbonization, by which time the value has dropped to about 420 B.Th.U. The resultant mixed gas has, as already shown, a value of about 625 B.Th.U. per cubic foot.

Specific Gravity.—From a maximum of about 0·6 in the first hour, there is a fairly regular fall to about 0·3 at the close.

Bye-Products.—The make of tar and liquor is naturally highest at the early stages; but it does not decrease very rapidly, as might be expected, until the last six hours or so are reached.

The temperatures in the dip-pipe, and before and after the condenser, have been recorded diagrammatically; but the records are not reproduced with the report as published.

The report concludes with a discussion of the advantages of the chamber settings over retorts; but as no points appear to be raised which have not been covered in Herr Ries' paper, of which a translation was given in last week's "Journal," it is unnecessary to reproduce this portion.

An interesting feature of the recent meeting of the British Association at Leicester was a joint discussion between the Engineering and Chemistry Sections on "Gaseous Explosions, with Special Reference to Temperature." In the course of it, Professor Harold B. Dixon gave an account of the methods he had employed for determining the specific heat of gases at high temperatures. Up to 400° C., compressed gases can be heated in steel bombs and dropped into a water calorimeter—the rise of temperature due to the steel being corrected by blank experiments. A distinct though small rise in the specific heat of carbon dioxide was thus established. A second method was to heat the gas in a tube 18 inches long, and measure the velocity of sound in the heated gas. By this means the specific heat of air and nitrogen and carbon dioxide up to 400° C. had been determined. The rise in the specific heat of carbon dioxide so found agreed well with the results obtained by Helbronn at Berlin.

IRISH ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Dublin.

The Annual Meeting of the Irish Association of Gas Managers, which took place in Dublin on Tuesday last, was the second in succession to be held in the Capital of Ireland; the reason for this being that the meeting last year was fixed in view of the anticipation that the International Exhibition was to have been held in Dublin in 1906. Though the anticipation was not fulfilled, the fixture of the meeting for Dublin was not altered; and when the Association met last year, it was felt that they were shut up to meeting again in Dublin in the Exhibition year. The gathering last Tuesday was held in the Lecture Theatre of the Royal Dublin Society, in Leinster House, Kildare Street—the same place as the Institution of Gas Engineers met in last June. When it is considered that there were doubts as to whether, in view of the meeting of the Institution, the Association should hold their meeting as an independent fixture, or whether they should not make theirs simultaneously with that of the Institution, and so obviate the call upon the members to travel twice to Dublin in the course of one summer, it was very gratifying to find that the gathering which met under the presidency of Mr. T. J. Reid, of Ballina, did not suffer in the matter of attendance by comparison with previous meetings, but was, in fact, better than some of them.

Welcome to the City.

Mr. Francis T. Cotton, on behalf of his father—Alderman W. F. Cotton, J.P., D.L.—expressed his father's regret at not being present to extend a hearty welcome to the Association. He had been detained in London, and could not possibly be with them. He could assure them that his father was looking forward with the very greatest pleasure to the opening of the proceedings of the meeting; and it was a matter of great disappointment to him that he could not be there. On his father's behalf, he declared the proceedings open.

Reports of the Committee and Auditor.

The Hon. Secretary (Mr. James Whimster, of Armagh) read the report of the Committee, which was as follows:—

The past year has been an eventful one in the annals of the gas industry in Ireland, on account of the most successful meeting of the Institution of Gas Engineers held in Dublin last June, and the interesting and comprehensive display in the Gas Pavilion of the Irish International Exhibition.

The remit which you made to your Committee from the last annual meeting, to take steps to welcome the Institution and to further the interests of the gas profession on the occasion of their assembling in Dublin, had your Committee's most careful attention. The result of their deliberations was the decision to hold our own annual meeting as usual in August, and to write to the Council of the Institution, assuring them of our pleasure at their intended visit to Ireland, and proffering any assistance in our power towards making their meeting a success and the visit a pleasant one for their members. Simultaneously with this action on our part, the Council of the Institution very generously invited a selected number of our members to represent this Association and form an Advisory Committee with the Council in making general arrangements for the meeting, and at the same time offered cards of admission to the meetings, with all the advantages (for the time being) of membership of the Institution, to all our ordinary members—a boon which your Committee were glad to see was highly appreciated and taken advantage of. This meeting, in the estimation of the Committee, amply demonstrated the wisdom of our becoming affiliated with the Institution.

The Committee are also pleased to see that one of our members had been elected an ordinary member of the Council of the Institution—Mr. Francis T. Cotton, of Dublin, a gentleman whose services in connection with the recent meeting cannot be over-estimated, and whom we heartily congratulate on his election.

Mr. Airth, your District Representative on the Council for the past year, reports as follows:—

> "I have attended all meetings of the Council of the Institution of Gas Engineers to which I was summoned.
>
> "The Council are endeavouring to get the Public Health and Local Conferences Act of 1885 so amended that all public bodies will be able to pay their engineers and managers expenses to our conferences. No definite progress can as yet be reported; but it is hoped that further representation to the Local Government Board may result in the achievement of this object.
>
> "Reduced railway fares, at the rate of fare-and-a-quarter have been granted by the Associated Railways to the Institution meeting in Dublin this year; and it is hoped that this will now become the regular fare to our meetings. It will all depend, however, on whether the members secure their tickets through the Secretary of the Institution, because if not, it will count against the privilege being again granted.
>
> "The examinations in Gas Engineering and Supply have, on the recommendation of the Council to the Technology Committee of the City and Guilds of London Institute, been further augmented by the inclusion of a separate examination in Gas Distribution. This will appear on the syllabus under the title of 'Gas: Its Distribution and Applications,' and will no doubt further enhance the value of these certificates to those who hold them.
>
> "The Council, after consultation with Professor Smithells, have established at the University of Leeds an 'Institution Fellowship in Gaseous Fuel' under Professor Bone, of the value of £100 per annum, and have promised to meet the incidenta expenses in connection therewith."

Mr. R. B. Anderson, our ex-President, has been duly elected our District Member of the Council for the current year.

The Committee have to deplore the loss of our old and valued friend Mr. F. Daniel Jones, of Dublin, who was a familiar figure at our annual gatherings, but who, during the past year, has been called over to the majority.

The abstract of accounts and Auditor's report presented herewith show a balance in hand of £70 4s. 1d.

The retiring members of the Committee are Messrs. Brodie, of Omagh, Allen, of Sligo, and Eustace, of Tullamore, who are not eligible for immediate re-election.

The Hon. Auditor (Mr. G. W. Norman, of Dublin) read his report, which certified the accounts to be correct.

The President moved the adoption of the reports.

Mr. P. Conroy (Galway) seconded, and the motion was adopted.

New Members.

The Hon. Secretary read the following list of applicants for admission to membership of the Association, and moved their election.

Ordinary Members.—Anderson, George W., Assoc.M.Inst.C.E., of Westminster; Kendrie, Jas., of Midleton, Co. Cork; Savile, G., of Drogheda; Watson, Mortimer, of Limavady.

Extraordinary Members.—Curtiss, Gerald, of Dublin; Galloway, D. B., of London; Phillips, L. P., of Dublin; Woods, R., of Dundrum.

The motion was agreed to.

Election of Office-Bearers.

Mr. R. Harrison (Monaghan) proposed that Mr. T. Frizelle, of Holywood, be elected President for the year. Mr. J. F. Tyndall (Wicklow) seconded; and the motion was agreed to.

Mr. Frizelle said he appreciated the honour they had conferred upon him. It had been unsought for by him; therefore it was the higher honour to him. He heartily thanked them, and invited the Association to come to Holywood next year, where he was sure they would be made heartily welcome.

Mr. F. J. Clarke (Ballinasloe) proposed that Mr. F. Eustace (Tullamore) be elected Vice-President. Mr. J. G. Tooms seconded; and the motion was agreed to.

Mr. Eustace thanked the members heartily for the honour conferred upon him.

Messrs. B. Mitchell (Bangor), J. E. Enright (Tralee), and R. Young (Youghal) were unanimously elected as Members of the Committee.

Mr. R. Bruce Anderson (Westminster) moved, and Mr. J. Grant (Tipperary) seconded, that Mr. Whimster be re-elected Hon. Secretary and Treasurer. The motion was agreed to.

Mr. Whimster returned his hearty thanks for the members' appreciation of his work as Secretary, as shown by their having cordially re-elected him. He had often said he would like it if they would make another choice. He would not keep on saying this; but as he had been nearly twenty-one years Secretary now, he thought it was time that someone else had a look in.

Mr. G. Airth (Dundalk) proposed that Mr. Norman should be re-elected Auditor; and this was agreed to.

Next Place of Meeting.

The President said that Mr. Frizelle had invited them to meet at Holywood next year. He thought they should accept this invitation; and he moved accordingly.

Mr. R. Pollock (Mauchline, Scotland) seconded; and the motion was agreed to.

The President's Address—Presentation of Medal.

The President then delivered his Presidential Address, which was given in the "Journal" last week (p. 441).

Mr. R. Bruce Anderson proposed a hearty vote of thanks to Mr. Reid for his most interesting and comprehensive inaugural address. He had dealt with a multifarious number of topics. It was not open to them to discuss the address; and although the President had humbly said there were certain points upon which they might not be in agreement with him, he was sure that, when they read the address, there would be very few points upon which they would not be in agreement with him. The President had been one of them for a very long time. He had been a most active member of the Association; and in electing him as their President, it was unanimously felt that they had got a very fitting man for the post. As it had become customary now in the Association, it became his very great pleasure indeed to decorate their worthy President with a very beautiful medal, which those who had already received it prized so highly. [He then placed the medal upon the President's breast, and assured him that it was a goodwill offering from all the members of the Association.]

The PRESIDENT begged to thank the members for the way in which they had received his address, and particularly Mr. Anderson, for the words he had spoken. In moments like this, when one was groping in his mind for the proper words to give expression to his thoughts, he generally fell back upon platitudes; and if he used the old platitude that this was the happiest moment of his existence, he should be simply saying what was the perfect truth. Mr. Anderson had said that he took an interest in the Association. He had done so; and he only regretted that he had not been in a position to take more interest in it. His remarks that day had been devoted to trying to provoke greater interest in the Association; and he sincerely trusted that what he had said would not be forgotten, but that next year their Secretary and President would not have the difficulty they had had this year in getting members to come forward and do something for the Association. He assured them the memento of a most interesting year which they had presented to him would be greatly prized.

A VISITOR FROM THE NORTH BRITISH ASSOCIATION.

The PRESIDENT observed that they had with them the President of the North British Association of Gas Managers, and he invited him to take a seat with them on the platform.

Mr. W. BLAIR (Helensburgh), having complied with the request, said he was very pleased to be with them once again. He had the pleasure of attending the meeting of the Association at Cork; and the hospitality and good fellowship he was shown by his brother gas managers in Ireland induced him to visit them once more to renew the friendships then formed, and also to see if there was anything to be picked up in the Exhibition in Dublin. He had listened with great interest and pleasure to the address of their worthy President. It contained a deal of matter which they would derive great benefit from, once they took it to their own firesides, and read it in the quiet of the evening. The President had been dealing ostensibly with small works; but he (Mr. Blair) thought that those who were in charge of larger works would receive a lot of benefit from it, for it was only in small economies that they could make any progress.

THE READING OF PAPERS.

The reading of papers, and the discussions upon them, were then taken. The papers were: "A Plea for Equality to Slot-Meter Consumers," by Mr. R. F. BYRON, of Nenagh (see p. 505); and "The Advisability of Installing a Water-Gas Plaut in Small Works," by Mr. W. H. ROBERTS, of Newtownards (see p. 507).

VOTES OF THANKS.

Mr. J. G. TOOMS proposed a hearty vote of thanks to the President for his distinguished conduct in the chair. When he was elected to that honourable positiou, each and all of them knew and felt that he would worthily fulfil the duties of the office to which he was then elected. He could assure the President, on behalf of the membhers, that they were more than satisfied with his occupation of the chair.

The PRESIDENT said he had again to thank them for their approval of his services to the Association.

The meeting then terminated.

THE DINNER.

In the evening, the members and friends, including a goodly proportion of ladies, dined together at the Palace Restaurant in the International Exhibition.

Mr. W. BLAIR (Helensburgh) proposed the toast of "The Irish Association of Gas Managers," which the PRESIDENT acknowledged, and proposed the toast of "Kindred Associations," which was acknowledged by Mr. R. POLLOCK, of Mauchline, who said he was proud to be a member of both the North British Association and of the Irish Association. Among the other toasts proposed were "The Press," by the HON. SECRETARY, and "The Hon. Secretary," by Mr. R. BRUCE ANDERSON, both of which were acknowledged.

After the dinner, the members inspected the Exhibition.

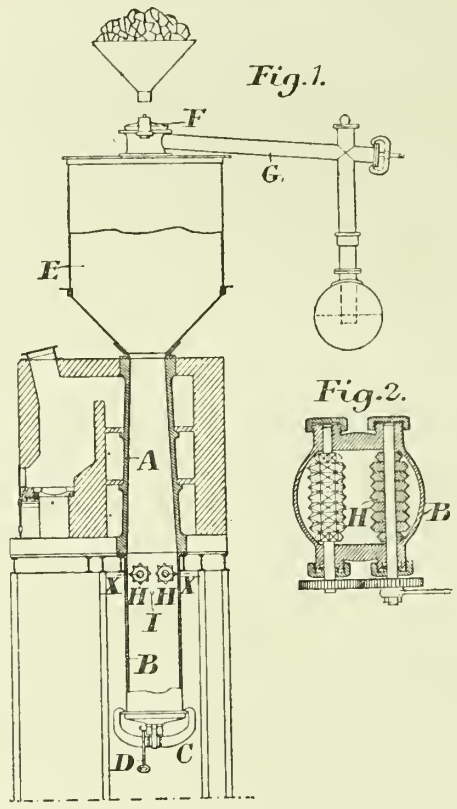
On Wednesday an excursion took place to the Shannon Lakes, which was well attended.

A FRENCH VERTICAL RETORT.

The current number of "Le Gaz" contains the specification of a patent taken out by M. Oscar Guillet for a new arrangement of vertical retort.

The patentee points out that all the processes hitherto employed for the distillation of coal, especially with a vertical retort, are attended by certaiu inconveniences. If the operation is continuous, and small quantities of coal are successively thrown into a partially filled retort, the result is superheating and decomposition of gas. If, on the other hand, the operation is intermitteut—the retort being completely filled and emptied at suitable intervals—the plant works irregularly, and does not allow of the utilization of the heat carried away by the glowing coke at the time of discharging the retorts. The apparatus which forms the object of the present invention has been constructed with a view to ensure the production of a greater quantity and better quality of gas, and the prevention of obstructions from tar and naphthalene.

In the accompanying illustration, fig. 1 is a vertical section of the retort; and fig. 2 (on a larger scale) a horizontal section along the line X of fig. 1.



French Vertical Retort.

The apparatus consists of a retort A, placed vertically in a suitable setting, which may be slightly cone-shaped to facilitate the fall of the charge. The retort is prolonged at the lower part by a cylinder B, closed with a water-tight plug C, which can be opened with a lever working an eccentric or any other suitable device. The retort is connected at the top part with a closed receptacle E, of sufficient capacity to hold the coal required for 12 to 24 hours' work, and also closed at the top with a water-tight plug F. A pipe G is branched on the receptacle for conveying away the gas. The cylinder B is crossed at the upper part by two suitably pivoted shafts, carrying pointed discs forming two coke-breaking cylinders H—the space between which is regulated so as to prevent the coke falling between them unless they are revolving. Moreover, the breakers can be replaced by any device which makes it possible to cause the fall of the coke, when required, into the box below—communication between the cylinder B and the retort remaining permanent. In the cylinder and below the coke-breakers (at the point I, for example) there is a spray of water, regulated in proportion to the result desired to be obtained. The object of this spray will be explained later.

Supposing the retort is filled with coal and at red heat, the receptacle E being full, if by suitable mechanism the two coke-breakers are made to rotate, for example, one quarter turn, a certain quantity of coke will be liberated from the retort and fall into the cylinder below. The charge in the retort will drop to the same extent, and a corresponding amount of coal will be fed into the retort from the receptacle E, the heating zone of which will, with care, be obtained as high as possible—*e.g.*, in the first third of the total height. This mass of coal will arrive in the form of a horizontal layer, and distillation will commence immediately. The gas produced will come into contact with coal which is gradually colder. It will thus be preserved from all decomposition, and at the same time will give off heat to the coal. Moreover, it will be filtered, so to speak, in the higher mass of cold coal, which will free it from a large portion of its impurities, more especially the heavy tars.

At the end of the period considered sufficient for the distillation of the layer of coal, the mechanism will again cause the cylinders H to revolve one quarter turn, and thus feed in the coal regularly. On the other hand, the spray of water falling on the hot coke on the bottom of the cylinder produces steam, which ascends through the mass of red-hot coke and cools it progressively. When it reaches the hot zone of the retort, it is decomposed in contact with the incandescent coke, and thus produces combustible gases which augment the volume of those given off by the coal. The same operation is continued until the cylinder B is almost filled with quenched coke. The plug C is then rapidly removed, and the coke drops to the ground.

Every twelve or fourteen hours, according to its capacity or to the period considered necessary for distillation, the receptacle E is filled with coal by means of a hopper above, as shown, or by any other arrangement whereby continuous distillation is ensured. One or several retorts can be placed in the same setting, so as to form a more or less powerful bench, according to requirements.

A PLEA FOR EQUALITY TO SLOT CONSUMERS.

By R. F. Byron, of Nenagh.

[A Paper read before the Irish Association of Gas Managers, Aug. 13.]

There is no matter connected with our industry that requires adjustment more than the present various systems of supplying gas through the prepayment or slot meter; and this must be my excuse for coming before you to-day with a paper containing nothing new or original.

Ireland is the home of small gas-works; and because of the heavy freight on our goods, the price of gas is, generally speaking, so high, that gas must be considered a luxury to the average prepayment consumer, who is not of the class that can afford luxuries. Therefore, if he will indulge in luxuries, let us encourage him by giving him our commodity at as reasonable a price as to his neighbour of the ordinary meter who purchases on credit. In any other commercial business, the cash customer obtains some little concession denied to the credit customer. Why should our business be an exception to this rule? True, the slot or cash consumer does not require as much gas as he of the ordinary meter; but is it for this reason that he is compelled to pay an extra price for his gas? In pleading for equality to the slot consumer, the writer only asks to have him placed upon equal terms with the ordinary consumer.

The prepayment meter has brought great wealth to many gas undertakings; so let us consider some of the methods by which the slot consumer is supplied with gas at present: (1) An additional price per 1000 cubic feet is charged to slot consumers in lieu of meter-rental. (2) All fittings and cookers are supplied, for which the gas authority seeks to pay itself by charging an extra price per 1000 cubic feet. (3) All fittings and cookers are supplied absolutely free of charge; the price of gas being the same as paid by the ordinary consumer. (4) All consumers are supplied upon similar conditions, except that prepayment meters are supplied free of rent.

The writer's experience of the first system of working is that it defeats the very object for which the slot-meter was intended—namely, to entice the outside public to become consumers of gas. He adopted this plan. But progress was so slow that he decided to give up the idea of charging any meter rent to slot consumers; and since doing so his number of prepayment consumers has steadily increased. One very great objection to the system is that consumers do not pay an equal proportion of meter-rental. He who should be encouraged (the good gas consumer) is forced to pay, in extra fees, perhaps five times the amount taken from another consumer with the same size of meter. Even among prepayment consumers themselves, therefore, there can be no equality with this system.

The second method is that adopted by many gas authorities in Ireland; so let us see how it works out. Take the average cost of fitting up a house with prepayment meter, cooker, one pendant, and two brackets, piping, &c., to be £5. Upon this sum it is usual to charge 10 per cent. for interest and depreciation—equal to 10s. per annum. Therefore, at an extra fee of 7½d. per 1000 cubic feet of gas sold, it is necessary to have a yearly sale of 16,000 cubic feet per meter before the gas authority's demands are satisfied in full. This average, the writer ventures to say, is very seldom reached in Ireland. Possibly this accounts for the fact that in some places the loading is as high as 1s. per 1000 cubic feet. The above remark about the good consumer being compelled to pay more than his share of rental applies here too; for he who burns 12,000 cubic feet of gas per annum pays four times the amount of rental accepted from his neighbour who burns only 3000 cubic feet yearly. Again, to fit up one man's house as he requires it done may cost only £1 10s., and in the next house an expenditure of £5 is necessary. Each consumes 10,000 cubic feet per annum, and, consequently, each pays the same rental. Surely, this is not as it ought to be. By straightforward dealing alone is it possible to retain the confidence of the public. Therefore, if an impression gets abroad that the gas company are not charging equal rental to their slot consumers, the success of the system is greatly interfered with. If the prepayment consumer is worth having, surely he is worth encouraging. With this system, there is no equality either.

Very heavy capital charges are involved in the third method of working; and it is the writer's opinion that, owing to the encouragement given to the very small consumer by the free fitting of his house, a considerable portion of the capital remains unproductive. What guarantee has the gas authority that such an investment as this will return a fair rate of interest? Is there not a distinct encouragement to the consumer to get what fittings he can out of the gas company, though he may never intend using some of them? Is not the ordinary consumer—the goose that lays the golden eggs—compelled to pay for his own fittings, while the slot consumer is supplied absolutely free of all cost? Therefore, there is no equality as between the prepayment and the ordinary consumer in this system.

The last method of supplying gas to the slot consumer is adopted by only a few gas authorities in Ireland—Nenagh being among the number. Under this system, the prepayment meters are supplied free; this being the only advantage given to the cash consumer. Wherever a cooker is required, a separate meter is supplied, so as to keep an exact record of the gas consumed for different purposes.

The average price required from the slot consumers in Nenagh is 6s. 5·24d. per 1000 cubic feet, as compared with 6s. 6·87d. demanded from the ordinary consumers, meter-rent included. But the amounts received were 6s. 5·29d. and 6s. 6·41d. per 1000 cubic feet, respectively—thus proving that the slot meter is a thoroughly reliable instrument.

At the end of his last financial year, the writer found that, of the total amount of gas disposed of, 23·49 per cent. passed through prepayment meters, with the result that his manfacturing expenditure showed an aggregate decrease of 3·03d. per 1000 cubic feet of gas sold.

Perhaps you will say that the expense of fitting up their own houses should be met by the same arguments as were advanced against the rental system—that of keeping the probable consumer away from you. To a certain extent, this is true. Undoubtedly, the public will not accept your services as quickly as if they were supplied with free fittings. But eventually they do come. On the other hand, the writer thinks that the fact of having to pay for his own requirements has the effect of keeping away the very small consumer. When the fittings are the property of the consumer, he will use them unless he is neglected in some way; but when the tenant has no interest in the fittings, he may tell you to remove them for some imaginary fault.

We cannot expect absolute equality in a matter of this kind; but should we not endeavour to get as near to it as possible? To do so we must, in my opinion, abolish meter-rents in every shape and form. The saving of 3·03d. per 1000 cubic feet is more than sufficient to pay the rent of all the meters in Nenagh twice over, thereby showing that there is a general gain to the Company through the profits on the consumption by consumers who would not otherwise have taken gas. If the price of coal will allow him to do so, it is the writer's intention to recommend such a step to his Directors; and, should they agree, all consumers will be on a perfect equality.

In conclusion, it is not the writer's intention to expatiate on the many other benefits to be derived by the introduction of the slot-meter, as they are already well known to you. In pleading for equality to the slot consumer, you are asked to remember that there are certain classes ready to have gas if they could obtain it in such a way and on such conditions as would suit their purses, as those consumers are not, generally speaking, blessed with an overabundance of this world's goods. Therefore, encourage them by supplying them at the same price per 1000 cubic feet as that charged to the ordinary consumer. The writer believes that this can be done with advantage to the gas authority; for what is being done at Nenagh can be done elsewhere. We should remember that by helping others we help ourselves.

Discussion.

The President (Mr. T. J. Reid, of Ballina) said they had heard a paper on a matter of interest to everyone. As he had hinted in his address, his opinion was that slot-meter consumers demanded particular attention—attention different from that which would be given in the larger towns. He had told the members of the policy pursued by railway companies, which was to charge what the traffic would bear. Gas managers sometimes had to charge what appeared to be unjust to their ordinary consumers; but sometimes this was a matter of expediency.

Mr. T. Frizelle (Holywood) said the paper was a capital one, and appealed to all members of the Association, as they all had to do with slot meters. Some did well, and others not so well. Mr. Byron had given his views very lucidly. Perhaps his (Mr. Frizelle's) place would come in under No. 4. He never did charge meter-rent for prepayment meters, though they cost more. He found, on beginning this business some years ago, that they could not induce the class of consumer which they wanted to get to pay extra money for the gas or a meter-rent. These customers wanted everything they could get, equal to the large consumers. When he looked into the question, he did so from the standpoint that these were poor people, and were a class of inhabitants who had never burned gas—nothing but oil and candles; and he thought if they could capture them it would come to something handsome. The first thing to do was to go to the small shops where oil was sold to poor people—to those who were making a living by it. They asked these shopkeepers to take gas. In the majority of the cases there were paraffin lamps in the shops. They told the shopkeepers that one incandescent gas-burner would give more light than three of the oil-lamps they had, and at less cost. They would thus get the incandescent light introduced into one shop. Then the opposition shop would have gas, and gradually they put gas into all the oil-selling shops. They had in this an advertisement to those who bought the oil—that when the people who made a living by selling oil were burning gas, it must be cheaper for them also to burn gas. The result was that they tapped the greater number of the poor people of Holywood in this way. They put the gas into these people's houses. To every person who lived in a house of less than £10 valuation, they put the gas in for 5s. 6d. a burner in their sitting-room or little front room, and a burner and a boiling-ring in the kitchen free of charge. The 5s. 6d. did not cover the cost. They put in a slot-cooker, which was a first-class one, costing about 50s., to any consumer who would use 8000 cubic feet of gas during the twelvemonth—this was for the cooker

alone. They sometimes burned as much as 13,000 to 15,000 cubic feet of gas, because they feared that if they did not do so, they would have to pay 4s. a year; and they were perfectly satisfied. They had 380 slot consumers at the end of their last financial year—the 31st of May. They averaged a consumption of 12,000 cubic feet through slot meters. This paid them very well. The population of the place was only about 5000; and they sold about 20 million cubic feet of gas; so the results went to show that, working with this class of consumer, the business paid well. Mr. Byron mentioned having a separate meter, so that he might get an exact record of the gas consumed for different purposes. He (Mr. Frizelle) did not use a separate meter. One meter was sufficient. Why a second meter should be put into a house of the description in question, he could not understand. It added materially to the cost. The way in which he counted the 8000 cubic feet a consumer used was this: He took the number of burners in the house, and averaged so many cubic feet for every point; and for the time they would be likely to be used. He did not proceed upon strict lines; he came and went with the people. If there was a complaint of any description with regard to the lighting, the cooker, the boiling-ring, or the meter, he sent at once to see to it, because if they kept a consumer without light or heat, they were losing every minute. As the result of all this, there was very little consumption of oil or candles in Holywood. He also paid every workman a commission for each new consumer he obtained—so much for a gas-cooker, and so much for a boiling ring; and this paid them also. He should explain that the 5s. 6d. was the fee they charged for fitting up the houses; the price of gas was 3s. 9d. per 1000 cubic feet to all consumers, for all purposes.

Mr. J. G. Tooms (Waterford) congratulated Mr. Byron upon bringing the subject before the meeting. It was a matter they could all very profitably consider and discuss. Mr. Byron pleaded for equality for slot consumers. His only excuse for joining in the discussion was that he had had experience of what he regarded as really strict equality for slot consumers. What he considered strict equality was treating slot consumers exactly the same as ordinary consumers, with the exception that the former used gas by prepaying for it. In Waterford, for some years they had 200 or 300 slot consumers; they had now something like 600, who had been treated identically with their ordinary consumers. If they had fittings for lighting, they paid for them; if they had a cooker, they either bought it or paid for the hire of it. He found some difficulty with this class of consumer, in setting the prepayment meters to exactly collect the proper amount per 1000 cubic feet of gas consumed. He also experienced some difficulty with a section of them in regard to the charges for the hire of cookers. The way they overcame these difficulties was by setting the meters slightly in advance of the ordinary price of gas, and refunding each year the amount overpaid. In all cases of slot consumers they gave a receipt for the money taken out of the meter, the same as for money paid on an ordinary account—on the quantity of gas shown on the indices, which were read quarterly. The consumption was worked out, and was charged for, at the ordinary rate; the amount of cash collected from the meter being credited, and if there were a surplus it was returned to the customer. He thought they would all agree that this was treating the slot consumer on a strict equality. He found in practice, however, that it was far from satisfactory, inasmuch as one consumer might have used gas very freely, consequently they would have to return 16s. or 18s. to him; but in the case of another consumer, who had used only a small quantity of gas, they might have to debit him with 3s. or 4s., in which case they made a practice of never debiting anything against a consumer. But it resulted in this, that one of the consumers would go to the gas office and want to know how it was that another had got 16s. or 18s. back, and she had got nothing. Any amount of explanation failed to convince some of these ladies that they had been treated at all as they deserved to be. Another thing they found, under this strict equality business with slot consumers, was that they certainly were not getting a certain amount of the business which they should have got. So, without abolishing their system of slot consumers being treated identically with ordinary consumers, they inaugurated another system of slot-meter consumption. This they called the slot installation business. He thought it would come under the heading of No. 2 in the paper. They had already obtained all the consumption which it was possible to get from ordinary slot consumers—and, by the way, he might remark that the ordinary meters changed over to slot meters were mostly among the poorer class, who certainly could not afford to pay for the hire of cookers. At that time their ordinary charge for gas was 4s. 3d. per 1000 cubic feet, with differential rates, and they fixed the price for slot consumers at 5s. They fitted up a cooker and three lights free; the three lights having incandescent burners. It was found, in connection with the first which were fixed, that the consumption of gas in the winter was a very negligeable quantity, and that the installations would certainly be unremunerative to the Company. After making inquiries, he found either the mantles were allowed to fall off, or the burners were not attended to. These consumers invariably declined to renew the mantles, and the burners were left dirty; so they decided, as an experiment, to give the slot installation, with all slot meters free. Since that time they had put in something like 500 more installations; and the last average he took of the consumption was 9000 cubic feet per consumer. The winter consumption was rather higher than the summer, due solely to the fact that their inspectors called upon each slot installation consumer, whether they were sent for or not, at regular intervals, and keep the lights in good order. They found it advantageous not to bother the consumer by asking him to sign an agreement that he would use 5000 cubic feet or any stated quantity of gas. His experience was that, when trying to get a consumer, if they told him he had to sign an agreement, he would be very chary of signing anything beyond the stereotyped application for a supply of gas on a particular system. They did not trouble the consumer to sign any agreement; and he considered that this had certainly been no mean factor in the success they attained in slot consumption. But, in order to protect themselves, each year he had a schedule made out of every consumer who had not taken £2 worth of gas. He then, with his slot inspector, went through the schedule, and marked off certain consumers who might have taken £5 or £10 worth of gas. These consumers were not cut off; they were simply informed that, owing to the small consumption for the preceding year, the service was unremunerative to the Gas Company, who would rather fix the stove and the meter to another consumer who would utilize them, and that unless they paid a meter-rent, as well as a cooker-rent, the installation would be removed. They served similar notices to all consumers. So that they had, practically, no idle capital, so far as meters and cookers were concerned, outstanding. Last year, out of about 1500 consumers, he had only to remove eight meters and installations; the others elected to pay 4s. or 8s., as the case might be, rather than let them take away the installation. He was afraid he had got away from a discussion on the paper; but he thought that, seeing he had had experience in treating such business (which he considered unique) on strict equality, his experience and opinions might be of some interest to the members of the Association.

Mr. R. Bruce Anderson (Westminster) joined with the others in thanking Mr. Byron for his most interesting paper, which was of a really useful class. The communication was, generally, a plea for equality. Mr. Byron had suggested one method, which he hardly approved of. He suggested making all consumers pay for their fittings, and then charging the same price. He thought equality was very desirable, but that they must treat ordinary consumers in the way in which many had been treating slot consumers, and give them free fittings. The system which he had had in use for a good many years now was to give slot consumers any fittings they liked up to the value of £6, including the slot meter and the cooker, conditional upon their using the cooker. He found that introducing these fittings to slot consumers free prevented their securing other small ordinary consumers. These were very reluctant to pay for £2 or £3 worth of gas-fittiugs in another man's house. It was really a matter of principle with them more than anything else. They did not like the idea of some people getting free fittings which they had no title to; and they did not like slot meters. What he would suggest was that they might supply a certain amount of fittings free of charge to ordinary consumers, and so put the whole of them on an equality; and he thought that in this direction there was scope for a good deal of development, which he had not managed to pick up by the slot meters.

The Hon. Secretary (Mr. J. Whimster, of Armagh) thanked Mr. Byron for coming forward freely and frankly, as he had done, with his paper. He agreed with those who had already spoken, that he had given them a thoroughly practical paper, on a subject in which every member had taken deep interest. He wondered that no more had joined in the discussion. He thought they would have been tumbling over each other to get a word in. As to the plea for equality to slot-meter consumers, from the experiences they had heard that day he did not think there was much need for the plea. Slot consumers seemed to be getting equality pretty well. So far as his own place was concerned, they were treated in precisely the same fashion as ordinary consumers. They gave them gas at the same price per 1000 cubic feet; they charged no meter-rents to anybody; and they supplied no free fittings, excepting that they occasionally put in a burner to stop a complaint and show that it was not the gas which was at fault, but simply the burners and fittings. Where they gave a slot cooker they charged a meter-rent, which was collected once a month—just when the cash-box was emptied. He could not tell them right off what the consumption per slot-meter consumer was; but it averaged somewhere about 12,000 cubic feet per annum. He had some 200 of them, over and above the ordinary consumers. Of course, there was this trouble with them, that occasionally people who did not require a slot meter, who were well able to pay, and whom they perfectly trusted, came and asked them to take away an ordinary meter and give them a slot one, so that they should not run an account. This became very troublesome. On the other hand, a slot meter was very convenient in dealing with the people from whom they could not get money. But he observed that if they got a prepayment meter, they burned more gas than they had done with an ordinary one—that was, taking the same class of people. It was not that ordinary meter consumers did not take the same quantity of gas, but the same class of consumer would burn more gas with a prepayment meter than if he had an ordinary one.

Mr. J. Richmond (Kilkenny) felt that the subject was one which he could do more justice to in a conversational way than in an argumentative discussion. It was a question which was interesting to the whole of them. What they were all trying to do was to develop their consumption. There were many difficulties in

the way of a few of the methods which had been enumerated. He had had some experience with one of them—the system of charging an excess price and returning the balance to the consumer; but, like Mr. Tooms, he had found it to be not very effective. He had also had experience of charging rent; but this was a system he never could enforce. People were apt to get cross, and ask them to take the whole thing away. There was no profit in taking it away, even though the consumption should be but a small one. He was adopting the No. 2 system in the paper—supplying all fittings and cookers, and charging all consumers an extra price indiscriminately. He found it very difficult to discriminate. Mr. Byron said it kept away the very small consumer. His experience was that they could not discriminate between who would be a good and who would be a bad consumer. He had had experience with houses where it might have been expected that they would be good consumers, with very bad results; and he had had experience in supplying houses which were really hovels, with first-rate results. Mr. Byron said they would require an extra fee of 7½d. per 1000 cubic feet, on a sale of 16,000 feet. He thought he was under a misapprehension as to the 10 per cent. He was going on the assumption that his usual price was the net cost price of the gas. Therefore, to get the interest he might be correct; but later on in his paper, he let them know that the slot installations he had already fixed brought down his manufacturing expenses by 3·03d. per 1000 cubic feet. This was an admission that the actual prime cost of gas into the holder must be only a matter of 2s. 6d.—or one-half of what his selling price was. Therefore, to get the price, as per the capital outlay, they must take into consideration what the prime cost of gas was, and the amount in excess of that would give them the profit.

Mr. J. Paterson (Queenstown) also thanked Mr. Byron for bringing the matter before them; but he would not like it to go forth from the meeting that gas was a luxury to the smallest consumer. He made it a strong point to the small consumers that gas was equally cheap, if not cheaper, to them. If it were used in an incandescent burner, light for light he considered that it was just as cheap.

The President considered they had had a fairly gratifying discussion on this important question; and he was sure that some of the members must feel both surprised and gratified to find that the subject was receiving the attention it was, and with the very good results which Mr. Frizelle and Mr. Tooms had experienced. He was very pleased to hear that Mr. Frizelle had got something like 380 slot consumers. As he had said before, it was all a question of expediency. If they wanted to do anything for slot consumers, they were obliged to give them gas at a low price. This might seem unjust to the ordinary consumers, but, after all, they could not take the price to the ordinary consumers as the gauge. It was the profit on the prime cost they would have to take into consideration. Gas cost so much into the holder; and anything beyond that was gain to them. It was no injustice, he should say, to the ordinary consumers that they should supply slot consumers at even less.

Mr. Byron thanked the gentlemen who had spoken for having given the meeting their experiences. He had not had the experience they had had—he had given them his own. Mr. Tooms had given him much more information than ever he had got before, for which he was exceedingly thankful. In Nenagh, their price was very high—6s. 8d. per 1000 cubic feet; and he found that, every year as they went on, it was the prepayment consumers who were coming to them. Their average was about 9000 cubic feet; and out of this they had to get about 2s. per 1000 feet for their debt. This was money they would not get but for the slot meters. He had considerably over 100 of them. His make of gas was increasing, and that it was so was due to the slot meters alone. He thanked the speakers for their kindness to him in what they had said.

Filtration Experiments at Washington.—A few months ago, some experiments in water purification were conducted by Major Spencer Cosby, of the Corps of Engineers, at Washington. According to "Engineering Record," three systems were employed: A, a rapid and a slow sand filter; B, a Maignen scrubber and a slow sand filter; C, a settling and coagulating basin and a slow sand filter. In a report recently made by Major Cosby, it is stated that no combination of filters has been found which satisfactorily clarified the Potomac water. He says that while the preliminary filters remove the greater part of the suspended matter, and leave comparatively very little work for the slow sand filters to do, the grains of mud remaining in the water after the first filtration are so exceedingly small that they are not entirely removed by either a second or third filtration. In order to arrest these fine grains, a layer of very finely powdered animal charcoal was applied to the surface of the slow sand filter of System B, but without any apparent success. The results from System C (the modified slow sand system) show, however, that it has so far been successful in keeping the water free at all times of turbidity by the occasional use of a coagulant and subsequent filtration. The experience thus far gained with this system indicates that it will be found to be the most practical method of clarifying the Potomac water at a reasonable cost, and at the same time utilizing the plant already installed. The bulk of the mud is not only removed by coagulation, but the small amount which remains is so changed in character that it can readily be removed by filtration.

ADVISABILITY OF INSTALLING A WATER-GAS PLANT IN SMALL GAS-WORKS.

By W. H. Roberts, of Newtownards.

[A Discussion introduced before the Irish Association of Gas Managers, Aug. 13.]

I am afraid the subject which I have ventured to introduce to-day will not receive the justice at my hands which it deserves, as it was only recently that I was requested to deal with it. However, I will endeavour, under this disadvantage, to bring forward as many useful points as possible for discussion, in the hope that my remarks will be supplemented by those who have had greater experience of water-gas plants than I can claim.

Let me say that I was led to think of the subject when certain improvements were contemplated in the Newtownards Gas-Works, of which I have charge; and, with a desire to attain greater economy of working, I began to compare the cost, utility, advantage, and disadvantage of a water-gas plant as against a coal-gas plant. Newtownards is a manufacturing town; and therefore we have a centre where there is a large day consumption. Not long ago, several of the manufacturers threatened to instal suction-gas plants; but we were able to meet them by a very substantial reduction—bringing the price down from 3s. to 2s. per 1000 cubic feet for trade purposes alone, according to amount used. The effect of this was not only to retain large consumers; but, in addition, a very large extra demand was created among manufacturers who had previously used steam and other means for power, &c.

Extension of the works, especially the gasholder capacity, has become necessary, seeing that my maximum output for 24 hours is actually double my storage capacity; but the consumption during lighting hours is exactly equal to the storage. This led me to believe that a water-gas plant would be useful in case of emergency. At the present time, I can work the retorts full and keep the supply going. This would be all very well but for the many little "supposes," which Mr. Shadbolt, of Grantham, referred to at the conference held two years ago at Dundalk. We are not prepared, in other words, for the unexpected; and I do not consider it is satisfactory to keep a spare bed of retorts to meet eventualities, which I find meantime to be the only alternative.

I believe it is generally found that, where a water-gas plant and a coal-gas plant are erected side by side, and worked up to their safe maximum, the cost is generally found to be slightly less than where coal gas is manufactured alone. My opinion is that, where coal gas-plant is capable of meeting the total demand, even with a water-gas plant at hand, it would not pay to work the latter save in emergency, for the following reasons: Much of the cost of coal gas consists of capital charges, depreciation, &c., arising, of course, from the original cost of the plant; and on the other hand, the cost of water-gas plant is comparatively slight. In coal gas the percentage chargeable on capital, depreciation, labour, &c., is greater than the cost of material; in water-gas, the reverse is the case. Therefore, to refer to the case of Newtownards again, seeing that the present coal-gas plant is capable of meeting all requirements, except in regard to holder space, and is likely to do so for a very long time, would it not be much more economical to incur the light capital charges of a water-gas plant, in order to be ready for any emergencies, than add storage to the present coal-gas plant? Even if the erection of a water-gas plant were the means of staving off the erection of a holder for only five years (assuming the cost of the holder to be £3500, and I find that a Dellwik water-gas plant could be erected for £700), in that time the saving effected in capital and interest would be equal to the amount spent on the water-gas plant.

A decided advantage on the side of a water-gas plant lies in the means it would afford for the using up of a surplus quantity of coke, which would otherwise have to be cleared off at a low price. When the price of coke is once dropped, there are difficulties in the way of raising it again. This is a very serious matter for a gas manager working under an urban council, because some of you are no doubt aware that "cheap coke for the poor" is a very popular election cry. There are always advocates of cheap coke on a council; and the price being once lowered, the manager will find himself strongly opposed if he attempts to raise it to the former figure again.

Another important point is the rapidity with which a water-gas plant can be brought into operation. Supposing an emergency occurs, and a shortage of coal gas becomes inevitable, a water-gas plant can be brought into requisition in the space of two hours. The water-gas plant I have mentioned would be capable of producing 150,000 cubic feet in 24 hours; and the difficulty should in this instance be surmounted. The old adage was that storage capacity must be measured by the maximum day's demand—this being based on the fact that it requires two or three days' heating of the retorts before the supply of gas can be augmented. But the circumstances are altered by the erection of a water-gas plant.

These are the points which have occured to me on the subject; and I place them before you in the hope that in the discussion to follow the expressions of opinion may prove useful to members of the Association, as well as to myself.

Discussion.

The President (Mr. T. J. Reid) thanked Mr. Roberts for coming forward at short notice and starting a discussion upon a

subject which he presumed every one of the members had had sometimes to consider—the way to make their holders go up. He was sure they would all be pleased to give expression to their views; and he hoped something tangible might result from the discussion.

Mr. G. Airth (Dundalk) said he had recently had the pleasure of meeting Mr. Roberts in Belfast, and they had then a little conversation on the subject he had brought forward. Of course, the advisability of installing water gas, or some other means of producing cheaper gas, had been the study of gas managers for many ages. At the present time, to be sure, they took much more interest in such a subject, considering they had all been hit to the tune of from 2s. 6d. to 4s. per ton for coal, and there did not seem much room for an increase in the return from residuals. Coke was sometimes so much of a nuisance that he would willingly spare a few tons of it to anyone. Tar, he thought, had reached its lowest ebb; it could not be much lower. When he had the honour of sitting in the chair of the Association, he spoke strongly of the methane-hydrogen plant. He still thought this plant met the necessities of the situation better than any other, because it used tar—not very much, he acknowledged, but still enough to enable them to get rid of some of it, and they would dispose of their surplus coke. The strike in Belfast had affected them to a very considerable extent. He had not been able to get any tar away; and if he had had a methane-hydrogen plant, he should have attempted to send out perhaps as high as 60 per cent. of methane gas. He had the pleasure, two or three years ago, of seeing the Truro plant for almost a week; and he was sure that if anyone went there, or to the larger plant which had been installed in the Great Western Railway Company's works at Swindon, two hours spent with it would amply repay him. It would likewise convince him of the possibility of benzolizing the gas, and mixing the methane-hydrogen gas and the coal gas thoroughly together. There was no shadow of a doubt as to the permanency of the benzole enrichment, either at Truro or at Swindon. The crude methane-hydrogen gas was enriched up to about 20-candle power before being mixed with the coal gas in the hydraulic main; and there could be no question as to the permanency of the enrichment, because after it went through the hydraulic main it had still to run the gauntlet of the foul main, the condensers, and so on. He thought no one could dispute that they were getting splendid results, when they were obtaining an enrichment value of 28 candles for each gallon of hydrocarbon they were using per 1000 cubic feet. In his opinion, this spoke well enough for it; and if he were asked to give his advice to Mr. Roberts, it would be changed slightly from what he gave him three weeks or a month previously. He thought the most economical way of applying the methane-hydrogen gas would be to use about one-third of it. It would be possible to employ it up to about 75 per cent.; but he believed the most economical way would be to use about 30 per cent. With this there would be, he thought, a saving of about 6d. per 1000 cubic feet—at least, there would be this saving as against the price of coal, taking it generally through Ireland at the present time. So that, if they used one-third of it in works making (say) 30 million cubic feet of gas a year, there would be a saving of about £500. Another thing was the saving effected by having their retorts always working up to the highest point they could; and in cases of emergency there was no necessity for any cutting down of pressure, as he had to do sometimes—and he supposed other people had to do it too. The plant could be got ready for work in less than two hours; and he did not think gas was likely to give out in that time. The last figure he got when he was in Truro—and they had obtained better results at Swindon—was that using 45 lbs. of coke, half-a-gallon of tar, and a third-of-a-gallon of benzol, and enriching the mixed gases up to 14 or 15 candle power, the cost was 8½d. per 1000 cubic feet. He was very pleased Mr. Roberts had brought the subject forward; and he hoped there would be a good expression of opinion as to what should be done, because it would assist some of them who might not be exactly in the same box, but who hoped to be.

Mr. J. G. Tooms (Waterford) thought that if they could get the view of someone else who had had actual experience of working a small carburetted water-gas plant, it would be of considerable value to the meeting. He merely rose to remark that anyone with whom he had ever been in conversation who had had practical experience with a small water-gas plant, invariably informed him that, though there were many what might be termed indefinable advantages in having such a plant at their hand, the cost was certainly considerably more than that of an up-to-date coal-gas plant. While this was so, they all knew that it was disputed by water-gas enthusiasts. If a paper were read about water gas, the sole object of the writer was to prove that he had not made a mistake in adopting it. He placed some value on the unbiassed actual experience of men who had had this plant installed; and he had never yet met a manager who had been sorry that he had adopted it, owing to the convenience it gave him in an emergency. But, invariably, he had been informed that, owing to the wear and tear of the engines, blowers, producer, and other parts of the apparatus, the cost in all cases had been much more than a coal-gas plant.

Mr. G. W. Anderson (Westminster) was in the position of having used water-gas plant in a small works about ten years ago. He was short of holder room, and he had all the advantages of a water-gas plant beautifully laid before him. He was told that, in case of emergency, he could turn on the gas, and that it was very much cheaper to make the same quantity with it than with coal-gas plant. Eventually he decided to put it up. The cost of the plant was considerably less than he would have had to pay for coal-gas plant. The cost of the gas, however, was a good deal more than that of coal-gas. He worked it a considerable time, and got to the ordinary ratio, more or less. He used about 3 gallons of oil per 1000 cubic feet of gas. The cost was more; but the difficulty he found—and he thought a good many people found, although they did not hear about it—was the question of mixing the gases. If they had not much gasholder room, they had to make all their water gas in the evening, and send it all out in the evening. But their average being from 20 to 25 per cent., they might, in the course of one half hour, be sending out 60 or 70 per cent., according to their gasholder accommodation. The percentage might vary very much during the hours of the evening. There were no inverted burners in those days, and very little incandescent lighting; but the effect upon gas-fires in the neighbourhood was very striking. These fires were adjusted for ordinary coal gas, and as long as they sent out this the result was satisfactory; but when they distributed a varying mixture of water gas and coal gas, the result was not satisfactory. They were told it was a splendid plant, and that when they were short they could make gas very quickly with it. There was no doubt about this. It was a grand apparatus. When they had a strike among the workmen they could rush the plant forward and give the consumers gas—of a kind, but still it kept the lights going. The question of cost resolved itself absolutely into what they paid for materials, and what they got for their coke. A little while ago he was in Buenos Ayres; and after a great amount of consideration, a water-gas plant was put up there. One of the great difficulties they had was the disposal of surplus coke. The plant was put up at a time when they had no coke; the surplus had all disappeared. High freights had made coal so dear that all the coke went away. He had to start the water-gas plant without any surplus stock of coke. He was buying coal in the works at 25s. per ton; and he had to pay £6 per ton for oil—roughly speaking, about 6d. per gallon. He thought that if they took these figures, they would find that it was not a very paying thing to use water gas. However, under the instruction of his Directors, the plant was started; and they worked away with it. They worked so well that they had to refuse to sell coke in order to keep the plant going. This, of course, was not business; but it had to be done under the special circumstances. The difficulty was so great that he had to go the length of buying Cardiff steam coal at 30s. per ton—using it in the retort-benches, so that he should have more surplus coke to employ in the water-gas plant. He was able to sell the coke from the retorts at £2 2s. per ton. There was another difficulty, in regard to the difference of pressure. Of course, the difference in the density of the gas came into consideration the same as in England. His wife was a very good critic. She did not know when they were making coal gas or water gas; but she used to watch the gas, and she would complain on the nights they had water gas. There was no doubt about it that she knew, from the lights in the house, when they were using water gas and when they were using coal gas. The incandescent burners showed it very clearly. The question of the regular quality of gas was, he thought, a thing which had to be more seriously considered than it had been recently. They had heard a great deal about the regular pressure of gas; but it was the regular quality they should attend to. They should give a regular quality of gas as well as a regular pressure; and he contended that, if they were short of gasholder accommodation, they could not give a regular quality of gas from hour to hour during the day. If their gasholder accommodation were ample for the ordinary day consumption, they might use water gas, provided the cost of material would enable them to do so. Mr. Roberts stated that, while working at a safe maximum with coal and water gas plant, they could make the gas cheaper than with coal-gas plant alone. But if they were working both at the maximum, they had no reserve; and therefore they must have more gasholder room to put the extra gas into. If they had gasholder room sufficient, then they could work the plants hour per hour, and get the gases mixed properly and give satisfaction to consumers; but so long as they had to depend upon water-gas plant for rushing a large quantity of gas through to consumers, he did not think they would be able to give satisfaction.

Mr. D. W. Tooms (Fermoy) considered that the system was one of great possibilities. In his works, the retorts were worked at their maximum in the winter; and it struck him that, as they eased off, the slack could be worked off with water-gas plant. They often had a bed working at half its capacity; and the carbonizing could not be nearly so good as when at its full capacity. There was a possibility that the water-gas plant could be worked profitably to take up the slack.

Mr. T. Frizelle (Holywood) said the difficulty was that of filling the holders. He went into the question of water gas some years ago. One of his Directors was a water-gas man. This was at the time when Mr. Sampson Fox was telling people that they could get gas at 6d. per 1000 cubic feet. There had been a great change in the size of the plants, and the manner of manufacturing this gas, compared with the first that were put on the market. The cost was then something prohibitive. In this matter, a good deal depended upon the requirements of the town. In his place, the consumers were all private ones. There were no public works; therefore they had a regular consumption, practically all through

the day and night. Mr. Roberts's case was different. So far as he could understand, at Newtownards they were practically idle from Friday to Monday, when a lot of retorts were lying off. So it resolved itself into a question of the requirements of other works. If they could do with the varying quality of the gas, it was all right. He could not do with this at all. If his gas dropped in illuminating power, he had letters from consumers next morning. He had to keep it as regular as possible—to take as much gas out of the coal as he could, but to give illuminating power.

Mr. R. Bruce Anderson (Westminster) said they were often told that, if they put up water-gas plant, they would command the coke market. This, he was afraid, was a fallacy, as he found that the price of coke in their markets was regulated a great deal more by the cost of importation than by the amount of coke they actually had to dispose of themselves. If they used a considerable quantity of their coke to make water gas, and so reduced the amount of coke they had to sell below the requirements of the neighbourhood, they could not raise the price of it, because, if they did, they would immediately have coke imported. In Mr. Roberts's case, the use of the Dellwik plant would be very much restricted, owing to the small proportion of blue gas he could introduce into his make. Another question was the short time during which the plant might be worked. It might be three hours, or up to seven or eight hours. They would have the same outlays whether they had a two or an eight hour run; and the quantity of coke required to fire up, and to let down, would be the same. This materially increased the cost of the gas; the cost being usually based, to them, upon long runs. The size of the works, in his opinion, was the controlling factor in the argument. In a large works, where there was ample storage, they could run the plant regularly, and in this way take advantage of all the economies that were attendant upon water gas; but in a small works, he was afraid they would find it of very little advantage.

Mr. Roberts, in replying, said that Mr. Airth had remarked about the price of methane-hydrogen gas being 8½d. per 1000 cubic feet. He had got the price about 1s.; and he reckoned that, with coal gas, the cost of handling, after deducting residuals, would be about 8½d. per 1000 cubic feet into the holder. This was really why he came to the conclusion that it would never pay to introduce water gas anywhere, unless it were absolutely necessary. The only thing that gave him an impression favourable to the putting down of a water-gas plant was the actual cost of the apparatus. The difference in the density of the gas had been remarked upon. He was considering that, if he put in the Dellwik plant, he would require a benzol plant along with it. He thought that the presence of the benzol would materially alter the density of the gas, so that the difference would not be found at the burners. Speaking from last year's experience, there were just three times during the whole season when he would really have given something to have had a water-gas plant standing beside him. This was a position he would like to remain in; for, if he required to use it frequently, it would be better to put up a holder, and not use water gas at all. Considering the cost, the only thing he felt in regard to water gas was that he would save (as he mentioned in his paper) the total cost of the water-gas plant in five years, in capital—that was to say, if they were able to run without extra storage. Then they would have the water-gas plant beside them, without further charge. This was really the position he was placed in. It worked out as a mere matter of cost; and as Mr. Frizelle, who knew the circumstances he was working under, remarked, he would put out 150,000 cubic feet per day from Monday to Friday, and he would drop down to 60,000 cubic feet per day from Friday to Monday. He thanked them for the kind manner in which they had received his paper.

River Pollution in the States.—A river pollution decision was recently given by the Massachusetts Supreme Judicial Court, in the case of *Parker v. The American Woollen Company*, to which attention is called by "Engineering Record." The Court has decided that there is no question about the right of each riparian owner to use the stream in a reasonable manner, according to the usages and wants of the community, which will not interfere with a similar use by the riparian owners above and below him. Many of the uses which properly may be made of the water of a natural stream by an upper riparian owner will have some tendency to defile the water, and it is inevitable for controversy to arise concerning what is permissible contamination. The Court rules that no riparian owner has the right to use the waters of a natural stream for such purposes or in such a way as will materially injure it for the use of a lower riparian owner, or to add to it substances which will make it unfit for use. Owing to the self-purification which takes place in streams, the law will not prevent the discharge of every small amount of polluting substance into the water, though this may be prevented by statute. The Court also makes the important ruling that the plaintiff is entitled to an injunction restraining the pollution of the stream, even though the pollution does not now interfere with any use he is making of its waters. The Court accordingly ordered a decree to be entered enjoining the defendant from emptying or discharging, or permitting to be emptied or discharged, into the brook above the plaintiff's premises any objectionable substances whatever, in quantities that would appreciably affect the purity of the waters when they reached the plaintiff's premises, or render them materially less fit for drinking, domestic, or other uses at that point than they were when they entered the defendant's premises.

SOUTH-EAST OF IRELAND GAS ASSOCIATION.

Quarterly Meeting at Wicklow.

The Quarterly Meeting of the South-East of Ireland Gas Association was held at Wicklow last Thursday—Mr. D. W. Tooms, of Fermoy (the Vice-President), in the chair. The members were accompanied by a number of lady friends, and some invited guests were also present. After going through the gas-works, and inspecting the alterations which are being made (described in the paper by Mr. G. W. Anderson given below), the visitors were hospitably entertained by the Wicklow Gas Company. Mr. J. F. Tyndall, the Resident Manager of the Company, presided.

At the close of the repast, Mr. D. W. Tooms said that, in the absence of the President of the Association (Mr. G. Lennon, of Dungarvan), the duty devolved upon him, as Vice-President, to propose a vote of thanks to the Wicklow Gas Company for their kind welcome and generous hospitality. Referring to the way in which the Company were reconstructing their works, he said a great deal of credit for this was due to Mr. Tyndall, as well as to Mr. Anderson, the Engineer of the Company. Mr. Tyndall, in responding, said it was a pleasure to the Company to entertain the visitors; and he only hoped that in visiting their works they would have seen something interesting and of profit to them in the reconstructions they were carrying out. Mr. Tooms proposed the health of the guests not members of the Association; and the toast was duly honoured and acknowledged.

Mr. G. W. Anderson then read the following paper, descriptive of the

EXTENSIONS AT THE WICKLOW GAS-WORKS.

The management of the Wicklow Gas Company, Limited, was placed in the hands of Messrs. Anderson Bros. (of which firm I am a member) early in March of this year. We found the works very congested, and in a somewhat dilapidated condition. There were three ovens containing in all ten retorts direct-fired in a small building and an annexe thereto, a fair-sized pipe condenser, 2 ft. by 6 ft. square purifiers, station meter (out of order and out of use), and two gasholders totalling about 20,000 cubic feet capacity, and a 6-inch governor for regulating the town pressure. As the gasholders were back-balanced and gave 2½ inches pressure, the governor was hardly necessary. There was no exhauster, washer, or scrubber. There were two coal-stores, each at some distance from the retort-house; necessitating, from their position, the occupation of much yard space in order to give access to them when receiving coal. There was a small house for the Manager, and a small workshop for the town fitters. On the district there were 137 ordinary and 34 slot consumers, 3 gas-cookers, 113 public lamps, and 3¾ miles of mains, from 6-inch downwards.

Prior to commencing operations to put the works into more modern order, we had to decide upon what scale they should be reconstructed. During the last winter the maximum consumption was about 30,000 cubic feet per day. Wicklow is a seaport, and a summer resort for Dublin holiday makers. We had very few data as to what the daily consumption in summer was. There had been little or no attempt to push the sale of gas by means of slot installations or gas-cookers. Eventually it was decided to reconstruct the works on a scale of 120,000 cubic feet of gas per day. The area of the works being one-fifth of an acre, there was not much room to play with. It was decided to pull down the old retort-house, the walls being in a somewhat ruinous condition, and to build a larger house, taking in the site of the old purifiers and the yard space between the old retort-house and a steel gasholder tank; to pull down and rebuild the retort-ovens with regenerative firing; supply and erect a water-cooled condenser; and provide an engine, exhauster, and washer; double the area of the purifiers, supply a scrubber and a new station meter, and rearrange the position of the governor. In order that all the apparatus requiring occasional or frequent attention should be at a spot convenient to the stoker on duty, it was decided to have the engine and exhauster, station meter, and governor all in one building close to the retort-house. Yard space being scarce, the scrubber was arranged to be placed over the engine-room. It being considered that the existing gasholder storage was already too small, the various portions of apparatus have been so arranged that it will be possible to erect a holder of 78,000 cubic feet capacity upon the site without disturbing any of the work now being executed.

At about the end of March, Mr. Tyndall, the Resident Manager, took up his duties. His first work was to reinstate the station meter, which he had had repaired by the makers. He has thereby been able to get a proper record of working almost from the date he entered upon the works. The house upon the works occupied by the late Manager was partly pulled down, so as to obtain some yard space for coke, and the remaining portion was arranged for stores and the Manager's office. No attempt has yet been made to give the Manager a house upon the works; but it is intended later on to demolish the buildings near the entrance, and erect suitable workshops and a Manager's house. The result of this propaganda so far has been very decided. We had on July 31: Ordinary consumers, 130; slot consumers, 103; length of mains, 4 miles; cookers in use, 96; public lamps, 113. On comparing this with the numbers on the 30th of March there will be noticed a reduction of seven ordinary consumers, some of these having

been transferred to slot cooker installations. There is an increase of 69 slot consumers and 93 cookers, while only a quarter of a mile of main has been required to get these extra customers.

Matters being sufficiently advanced, gas making was concentrated on a bed of three retorts in the annexe to the retort-house. This necessitated disconnecting the hydraulic main in the other two beds, and the building of a small chimney; the old one having to be pulled down, the roof removed, and as much of the retort-house walls as could be spared taken down. The new purifier (about 10 feet square) was erected in its permanent position in the corner of one of the old coal-stores, and connected to the condenser temporarily with a 2-inch barrel pipe. The old purifiers and connections were then cleared out of the way, and the foundations for the retort-bench and the retort-house proceeded with. For the new retort-setting, it was decided to provide two ovens—one for five retorts, 15 in. by 8 ft. 6 in. long, and one for nine with regenerators, and with producers alongside the ovens so arranged that either producer can fire one or both benches. The first brick for the retort-benches was laid on Friday, June 21, and the bed of five retorts was put under a drying fire on Wednesday, July 30, and gaseous firing commenced on Tuesday, Aug. 6.

Their principal energies had been concentrated on getting this bench ready for work, while at the same time preparation for, and erection of, the general apparatus was proceeded with. Walls for the new coal-store and retort-house have been built. A coal-store capable of holding 250 tons has been arranged immediately in front of the retort-benches, and into this coal can be carted direct. Wicklow being a seaport, it is not necessary to keep more than six weeks' stock of coal, which at the present winter output can be placed down in front of benches. The summer has been a very broken one. You will understand, therefore, that it has been a somewhat anxious race against time to get the retorts ready before the lamplighting season sets in. We had no roofs, and all the brickwork had to be constructed in the open air. The anxiety was increased by absence of data as to what really had been the consumption in the former summer seasons, and what it would be on account of the increase in the consumers.

It may be thought that it was injudicious to take on so many new consumers before the new works were ready; but we took the risk of this rather than lose probably twelve months' consumption from new consumers. The result shows we were justified, as we have not had a moment's cessation of supply, and have kept more pressure upon the town during the period of alterations than had formerly been the practice. Under the circumstances, the retort-bench had to be put under fire much sooner than is advisable. There had been no time to allow the brickwork to dry atmospherically. By careful attention to slow firing, however, no mischief has been done; the retorts having been charged very lightly at first. Except the boundary walls, two gasholders, and the old coal-store, everything on the works is new. The old retorts were large—22 in. by 15 in. diameter. As I do not approve of this shape for small works, 15-inch rounds have been substituted. The ascension-pipes are 5-inch. A separate hydraulic main is provided for each bench; the mains being carried by the buckstays, and not from the brickwork of the ovens. A 6-inch foul main runs round the coal-store, and is provided at all corners with suitable clearing flanges. The condenser is a vertical tubular water condenser for 60,000 cubic feet, arranged with reversible connections (on the system originated by Mr. Browne, of Vauxhall). Space has been left to erect an additional condenser when required. The exhauster is for 5000 cubic feet per hour, with a 3 H.P. Crossley gas-engine to drive it and the scrubber. The washer is of the Livesey type, and the scrubber a Clapham "Eclipse." Two old purifiers were utilized by joining them by open pipes, so that they form one vessel. The new purifier, 10 feet square, is of the luteless type, and has a corner taken off it to allow room for the proposed gasholder tank, which will probably be constructed next spring. A second-hand station meter (purchased from a neighbouring gas company) has been installed near to the exhauster-engine, and the old town governor removed and refixed near to the station meter. All the underground pipes on the works have been rearranged and relaid, and in due time the yard will be paved, so that the Manager may have a clean place for his men to work in.

I think Mr. Tyndall is to be congratulated on the amount of work he has been able to get through, while at the same time keeping the works going and adding so largely to the number of consumers. He was ably assisted by Mr. Richmond, whom we sent over from Kilkenny, and who remained on the works looking after the reconstruction until we saw clearly that the security of continuity of gas supply was reasonably assured, and while Mr. Tyndall was attending to district work. We felt it most desirable that there should be a thoroughly competent man on the alterations during all the working hours, so as to give the Manager time to attend to the town's wants. The work generally has been carried out by local men; the only contractor's man being the fitter to erect the scrubber. Though not finished, the work is sufficiently advanced to enable you to see the general outline of our plans. You will have noticed that the architecture is of no particular period, much to the disgust, I am afraid, of the Resident Manager. We had, however, to utilize as much of the old material as possible. The retort-benches are free to move independently of the retort-house walls, and are not being connected with them except at the back. The condenser is set on joist irons about 8 feet above the ground level. This is to enable the tar to be sent by gravity to tanks over ground, from which the barrels into which it is loaded will be filled without any pumping. The scrubber being overhead enables the outflowing liquor to go direct through the washer also without pumping. So far as Mr. Tyndall can do so, the balance-weights will be removed from the gasholders, in order that more pressure may be given to the town when desired. The roof of the retort-house is of the well-known Irish truss wooden kind, covered with felting; and part of the new coal-store is covered by roofing removed from the old retort-house.

As to the cost, the work not yet being concluded, I am not at present in a position to say how much these alterations will cost, but I think something under £1500. We expect that by the end of September the alterations will be completed, and that the Manager may have a quite time for relaxation to make up the cost preparatory to his facing his first winter season in Wicklow.

Discussion.

The Chairman, in opening the discussion, remarked that the paper was an excellent one, and contained a good deal of information.

Mr. J. G. Tooms (Waterford) said that during the reading of the paper the point that struck him first was the value of station-meter records, and it would be noticed that the first thing that had been done at the Wicklow works was to put the station meter into thorough order. The next thing, the enormous increase in cookers and in slot meter consumers. This showed, where the means for extension were available, what could be done immediately, without much waste of time in sowing the seed. He thought he was correct in stating that within three months of the works coming under new management the gross number of consumers increased by something like 60 per cent., cookers from 3 to 96, and slot meters by 34 to 69, while ordinary meters decreased by 7. In so short a time, this alone constituted a record for any works, either in Ireland or on the other side of the Channel. It reflected very great credit indeed on his friend Mr. Tyndall. In the scheme of alterations, new purifiers had to be bought and placed in position. The building of new settings from the foundation and the firing of them after 37 days was a record for any works. He was in agreement, after considerable experience, with the reader of the paper as to the advantage of round retorts over the oval or the ⌂ shape. He considered some of the relatively best results he had ever had were obtained from 15-inch round retorts. He should like to ask the author of the paper if he had made any estimate as to whether or not there was a saving in carrying out all the extensions by means of local labour under efficient supervision, as against letting the work out under contract to the usual gas-works contractors. He thought this would be valuable information to have. With regard to the wood roofing of retort-houses, which had been referred to in the paper, he had seven years' experience of such roofs, and found them eminently satisfactory in every respect. It afforded him a great deal of pleasure to congratulate Mr. Tyndall on the manner in which he had interpreted the plans of the Engineer, and the successful way in which he had carried out the alterations.

Mr. T. Hornby (Mallow), referring to Mr. Anderson's remarks about retorts, said he preferred oval to round ones; but he should like to know Mr. Anderson's reason for stating that the latter were the best.

Mr. R. Bruce Anderson (London) said before the management decided upon the alterations it occurred to them to see what grounds were available beside the works, in order that they might acquire them for the purposes of their extension scheme. There were two plots of land which would have suited their purpose admirably; but circumstances prevented their acquisition, and so they had to adopt the plan of alterations described. He had to draw their attention to the fact that while these were in progress the supply of gas to the town had to be maintained; so that they had not an opportunity of having a clean sweep of plant, but had to keep some of the old plant in position till they would get the new at work. It was almost impossible to tell how long it would occupy in getting the work done. By doing it themselves, however, they could economize very much; whereas if they had a contractor to deal with, and he was kept waiting and had no other job on which to employ his men, he would have to put on an enormous bill of extras so as to make a profit.

Mr. T. P. Newbold (the Secretary of the old Gas Company), said, with regard to the alterations, he knew there was necessity for them; but the only difference between himself and Mr. Anderson was that he (Mr. Newbold) did not know how to effect them. He had been for years thinking daily and nightly how the alterations could be made; but he never found the solution till he saw Mr. Anderson's plans, which were a marvel to him. He hoped Messrs. Anderson and Mr. Tyndall would meet with the success they deserved for the employment they had given in Wicklow, the extension they had made in the gas-works, and the general improvement effected in the public and private lighting.

Mr. Tyndall said it was his whole heart's desire to interpret Mr. Anderson's plans to the best advantage; and he hoped when the works were finished he would find satisfaction from them.

Mr. G. W. Norman (Dublin), referring to the retorts, said he did not know what Mr. Anderson's object was in putting in small round retorts, as he (the speaker) always thought that the ⌂ retort—so like a flat-bottomed kettle—gave a better heat, that the round one was best for clearing out the coke, and that the oval

was the happy medium. With regard to the carrying out of the work, he thought the new departure adopted was a very good one because it was giving employment to the people in the town from which they derived their profit.

Mr. J. PATERSON (Queenstown) thought it was very creditable to be able to erect works with an ultimate output of about 20 million cubic feet on one-fifth of an acre of land. He was very much struck with the great increase in the consumers and also in the number of cookers. With regard to the installation of round retorts, he quite agreed that they were the best for either small or large works. His opinion was that they got more gas from a ton of coal by them; they were also much easier to stoke, and were more easily drawn. D retorts made very poor coke, and were much harder to draw.

Mr. T. Frizelle (Holywood), the President of the Irish Association of Gas Managers, remarked that what appealed to him forcibly was the short time in which the alterations had been carried out. He did not believe in hanging over a job. He was continually putting it into his men that when anything was to be done it must be done as quick as they could do it. The Wicklow Company were to be congratulated on their Manager, who within six months had increased the number of consumers by 62, laid a quarter-of-a-mile of main, and put in 96 cookers, in addition to giving his available aid in the reconstruction of the works. He (Mr. Frizelle) expected a good deal from Mr. Tyndall, and he had realized his expectations.

Mr. B. MITCHELL (Bangor) also referred to the progress made.

The CHAIRMAN said, taking into account the state the works were in six months ago, the progress made was something near the marvellous; and, in addition, they had kept up the supply of gas in the town without any hitch whatever. Most of them had had a good deal of experience in reconstruction; but he did not know of any works since his connection with Messrs. Anderson that had made such a sweep as had been done at Wicklow.

Mr. G. W. ANDERSON, answering Mr. Tooms as to the saving effected by employing local labour as against contractors, said he had not made any estimate. He had been accustomed all his life to doing his own work, and he did not see why they should not do the same in Wicklow. A very important feature in it, to his mind, was that it gave the Manager scope, and enabled them to see what sort of a man he was. Where they could, they should always get work done locally. With regard to the round retorts, he preferred them in small works where they had no machinery to work them; but in large works he preferred the oval or D. The round retort was easier to draw, made much better coke, and very little breeze. Referring to the commercial side of the business, when the works were taken over from the old Company, he had no fault whatever to find. Mr. Newbold had his books and everything in connection with the consumers in most perfect order. He was most useful to them; and they were extremely grateful to him for the assistance he had given them. In conclusion, he said they had spent in wages from £30 to £35 a week for the last four months; and the Wicklow men had done their work well.

A general discussion then took place, after which a vote of thanks was passed to the Chairman, and the proceedings terminated.

Test of a Crossley Gas-Engine.

A report has lately been published on the result of some trials carried out by Dr. J. T. Nicolson, of the Manchester University, of a gas-engine made by Crossley Bros., Limited. The tests were undertaken with the object of measuring the brake-horse-power of the engine, and gauging the gas consumption per hour. Observations were also made on the speed variation of the engine between full and light load, so as to test the new system of governing introduced by Messrs. Crossley, which acts by varying the timing of the first admission of the gas while always cutting off at the end of the stroke. The gas used was made from bituminous slack coal in a Crossley producer plant; and its calorific value, on analysis, was 156·5 B.Th.U. per cubic foot. Tested by a Junkers calorimeter, the value obtained was 149 B.Th.U. per cubic foot, at the temperature and pressure of the instrument. The volume of the gas used by the engine per hour was 31,368 cubic feet, at 20° C. and a pressure of 2½ inches of water. This equals 29,037 cubic feet of gas at 0° C. (32° Fahr.) and 760 mm. of mercury. The barometer readings were 30·21 inches. The brake-horse-power worked out to 559. The gas used by the engine per hour at 32° Fahr. and 29·92 inches of mercury was therefore 51·94 cubic feet. Hence the heat supplied was $51{\cdot}94 \times 156\frac{1}{2} = 8128$ B.Th.U. per brake-horse-power-hour. The thermal efficiency was accordingly $2546 \div 8128 = 0{\cdot}3132$, or 31·32 per cent. This result is declared to be highly satisfactory. The engine was found to vary in speed from 119·4 to 121·4 revolutions per minute when the horse power was instantaneously dropped from about 600 to 50. This represents a total variation of $1\frac{3}{4}$ per cent. of the mean speed. The full load was then thrown on again as quickly as possible; the same process being repeated again and again. It is said the speed never varied more than the percentage mentioned above.

The death is announced, as having taken place on the 8th inst., of the wife of Mr. A. C. Fraser, at present of Salford, but formerly Gas Engineer at Bolton, Loughborough, Neasden, &c. Mrs. Fraser, who was 67 years of age, died after an illness of nearly five years' duration.

RECENT PROGRESS IN THE GAS INDUSTRY.

An Interesting Address by Herr Blum.

At the last meeting of the Austro-Hungarian Association of Gas and Water Engineers, held in Vienna on May 31 and June 1, a paper was read by Herr E. Blum, of Berlin, entitled "A Review of Recent Progress in the Gas Industry." From the text of the paper, published in "Gastechniker," we get the following particulars of the speaker's remarks.

After referring briefly to the great improvements that had been effected during the past ten years or so in the methods for the consumption of gas, chiefly through the discoveries of Baron Auer von Welsbach, which had led to the possibility of obtaining 1-candle power of light for every litre of gas burnt, Herr Blum expressed the opinion that the gas industry had progressed at least as rapidly as the electrical industry, and that, though great hopes were based by the electricians on the new metallic filament lamps brought out a short time ago, there was little reason to think that further advances would not be made in the manufacture and consumption of coal gas which should enable the industry to hold its own as successfully as it had done in times gone by.

Two great problems confronted the gas engineer of to-day. Firstly, to discover cheap and efficient methods of moving large quantities of material into the desired places; secondly, to seek economy in the actual manufacture of gas. For several years past the price of coal had risen, and it would probably continue to do so. Rates and taxes had increased, wages had grown, yet the price at which gas was sold had fallen. In view of the competition with electricity, in view of the increasing demands of the public for light, and the severity of modern existence, it was necessary that the price of gas should continue to fall; and to enable it to do so the engineer must secure the utmost economy in his manufacturing charges, and must reduce to the lowest point possible the amount of manual labour employed. Referring more particularly to the question of labour, Herr Blum discussed the introduction of machinery on a gas-works, urging the great desirability of employing men for their intelligence rather than for the muscle they possessed. The more that men were studied by relieving them of exhausting physical labour, and the more their capacity was increased by providing them with machinery, the higher the wages they could profitably be paid, and the fewer would be the difficulties of a Socialistic character with which the engineer would have to cope.

On the lines he had already laid down, the author regarded as of the utmost importance to the gas industry the changes that had already come, and were now gradually coming, over the nature of the vessels in which coal was converted into gas. The old-fashioned horizontal retort must be charged and discharged by shovel, scoop, or machine; the inclined retort was its superior, inasmuch as the force of gravitation was made to do much of the work; while the vertical retort was better still, for gravitation was employed to the maximum degree possible, the number of stokers necessary was largely reduced, and their labour—more particularly the severity of their labour—was minimized. Furthermore, the introduction of carbonizing vessels larger in size than the conventional retort was advantageous, inasmuch as the carbonizing periods were lengthened. The carbonizing period of twelve hours, which was gradually being adopted, had manifold advantages. It enabled shifts of twelve hours instead of four hours to be worked, and might well lead to a great reduction in the amount of work necessarily done during the night. In other directions, too, the vertical retort was superior to the horizontal; for it was charged to complete fullness, and was worked off at a higher temperature than its predecessor. The higher temperature was permissible because as the retort was quite full of coal, a layer of coke was first formed at its periphery, so that the interior actually remained at a comparatively low temperature, and the coal therefore yielded a thinner tar, together with a larger output of ammonia. An increase of 60 to 70 per cent. in the yield of ammonia was a very important consideration at the present time. It was necessary to remember that the great advantage that a gas-works possessed, in comparison with an electricity generating station, was that the former did not destroy the whole of the fuel, but enabled the bye-products to be recovered which to a large extent paid back the expense of purchasing the raw material. The use of vertical retorts not only augmented the make of ammonia, but gave a gas free from naphthalene—a substance that might be deemed the chief thorn in the flesh of the gas engineer. In large towns it often happened that hundreds of naphthalene stoppages had to be attended to per day, blocking consumers' connections and the public lamps. The possibility of avoiding this trouble opened a happy vista to the gas maker.

Herr Blum went on to discuss the merits of the large carbonizing vessels employed at Munich,* where the coal was heated in chambers something like horizontal coke-ovens, but provided with sloping bottoms whereby the coal distributed itself uniformly, and the coke afterwards fell out under the influence of gravitation. The general carbonizing operation went on in a very similar manner to that in the vertical retort, though certain differences

* An abstract translation of a paper dealing with these chambers, communicated by Herr Ries to the German Gas Association, appeared in our issue for Aug. 13, p. 438.

prevailed. The Munich ovens were recharged every twenty-four hours, and were so large that there was practically nothing to do during the night. There were 150 of these ovens already in use or in process of erection; and the speaker believed that they had a great future before them. Dealing with other matters, the author spoke of the modern arrangements for coke handling, for which purpose the De Brouwer conveyor was so valnable an appliance. It was difficult to overestimate the advantages of a system where the coke fell automatically ont of the retorts and was taken into store by purely mechanical means.

Great advances had been made in the direction of purification and the treatment of bye-products. The complete removal of ammonia and of naphthalene from the gas followed largely upon the use of vertical retorts; but improvements had also been made in reducing the speed at which gas passed through the purifiers and in subdividing it more perfectly. Years ago the ammonia recovered on a gas-works was stored as liquor and sold as such. Now it was almost invariably converted into ammonium sulphate, liquid ammonia, or ammonium chloride. Hence the great underground liquor tanks used twenty years ago had largely disappeared, for the store now kept was only sufficient to last an ammonia plant for two or three days. Similarly with tar; for it was nsually distilled and stored in the form of finished prodncts. Uncontrollable losses of ammonia and tar occnrred from the old subterranean tanks. Now the small quantities which had to be kept were stored in tanks above ground, where every leakage could be instantly detected and where the tar would settle so well as to be practically anhydrous; while evaporation of the ammonia was no longer possible. On the whole, it might be said that, throngh the introduction of machinery, through improvements in carbonizing vessels, and through carefnl recovery of the bye-products the gas could be made for about "10 heller per cnbic metre" [abont 2s. 4d. per 1000 cubic feet] less than in the early days of the industry. Indeed, the improvements that had been introduced in the new gas-works at Nuremberg had lowered the cost of making gas by abont 0·8 pf. per cubic metre [2·8d. per 1000 cubic feet] from what it was in the older works.

Herr Blum proceeded to express the opinion that, with certain exceptions, the scientific and engineering problems involved in the design and construction of plant were not stndied so thoroughly by gas-makers as was the case among electricians when erecting a new generating station—even methods for popularizing the nse of gas and stimulating its sale were not made the most of. In some German cities women were engaged to go among the consumers and teach the best methods of cmploying the gas-cooker, meeting with far greater success than men. Indeed, in the Munich Gas-Works classes for gas cooking were held which were attended by large nnmbers of girls. The author also remarked on the necessity for seeing that the pressnre was sufficient in all parts of the district served by a gas nndertaking, and that consumers' mantles were changed with proper frequency. Gas incontestibly gave a better light than electricity—one which properly illnminated a room and did not harm the eyes by exposing them to the extreme brilliancy of a glowing electric filament. On the other hand, the manner in which the electric light conld be turned on and off was a great point in its favonr; and if something strictly analogous to the switch conld be devised for application to gas, great advances would rapidly be made.

Herr Blum brought his paper to a conclnsion by describing an appliance he used with great satisfaction in his own residence. He had installed an apparatus of the usual kind for increasing the pressnre of his gas, and had also fitted every pendant with a small tube running to a convenient place, where it terminated in a rubber ball which conld be compressed by a switch. The balls and the tubes contained gas under pressure; while each pendant was fitted with a special valve so that the extra pressure communicated to one particular pendant did not affect the others. The switches were situated in numerous parts of the house—in the entrance hall and in the npper landings, for instance, so that lights could be turned up or down from almost any place. The author considered that the only remaining disadvantage of gas was the heat it evolved on combnstion. While this was very pleasant in the winter, it was inconvenient in the summer; and he hoped that improvements in existing systems of domestic ventilation would soon be devised which should remove this solitary defect.

Monazite Production in the Past Year.—In the current issue of the "Jonrnal of the Society of Chemical Industry," some statistics are quoted from the United States Geological Survey in regard to the production of monazite last year—all from North and South Carolina. It is stated that the grade of the sand was so variable, and the prices realized on different lots were so irregular, that cleaned sand was nsed as an estimate of the quantity of monazite produced; an additional reason for so doing being furnished by the fact that the greater part of the crude material is cleaned by local mills before shipment, and the grade brought np to 80 per cent. or more of monazite. On this basis, North Carolina prodnced 607,275 lbs. of the mineral, valued at $125,510; and South Carolina, 148,900 lbs., valued at $26,802. The total for the United States amounted to 846,175 lbs., valued at $152,312. The production for 1905 was 1,352,418 lbs., valued at $163,408. This amount represented in part crude and in part cleaned sand. The monazite market in the United States in 1906 was fairly strong, despite the fact that the price of thorium nitrate was reduced nearly half early in the year by the German combine.

RECENT ADVANCES IN THE MANUFACTURE AND USE OF BLUE WATER GAS.

A paper on recent advances in the production and ntilization of uncarburetted water gas was read by Herr Reitmayer before the last meeting of the Austro-Hungarian Association of Gas and Water Engineers, and was subsequently printed in our contemporary, "Gastechniker."

In the first portion of his paper, Herr Reitmayer discussed some of the fundamental principles underlying the successful manufacture of water gas, comparing the ideal producer with a smith's forge where a shallow bed of fuel was raised to incandescence by a cnrrent of air travelling at high speed in such fashion that the carbon dioxide formed passed away from the zone of reaction without having any opportunity of reduction to carbon monoxide. The author remarked that it was not possible to construct an actual prodncer on lines closely resembling the forge; but it was possible to make it resemble the ordinary open coke basket in which a colnmn of burning coke received its supply of air not merely from underneath, but on all sides and at different levels. Hence, though the carbon dioxide which was first of all formed was immediately reduced once or several times, it nevertheless met with a fresh supply of oxygen and was fully oxidized again.

The water-gas installation in which Herr Reitmayer was interested was sitnated at Wiesenthal, on the borders of Bohemia. The plant consisted of two producers, constructed on the foregoing lines. Full details respecting them were not given in the paper, but the author stated that it was found possible to work the plant under such conditions that the proportion of carbon dioxide remained constant at about 17 per cent. throughout the whole period of the blow. The producers were also apparently so designed that during the run the steam was admitted at the top and at the sides of the vessels. In this manner, perhaps part of the steam passed downwards through the producer near the sides without penetrating the whole column of fuel; but even if this happened it was advantageous, inasmuch as the centre of the incandescent coke was not cooled as suddenly as was usually the case, for the steam did not come into immediate contact with the coke until it reached the lowest part of the prodncer, where the temperatnre was at its maximum. It might be thought that such a method of working resulted in the presence of a large quantity of undecomposed steam in the water gas, together with a high percentage of carbon dioxide. This, however, was not found to be the case. The carbon dioxide in the water gas did not exceed 5 or 6 per cent.—practically the same proportion as that present in the gas made in other plants, and the water vapour remained also at a normal percentage.

Herr Reitmayer's water-gas plant had been in regnlar operation for abont eighteen months at the time when he read his paper, and had worked without a single hitch. Great difficulties were experienced in building it; for it was erected at a time when the temperature of the air in the monntainous region served by the nndertaking was some 50° below freezing point, and when it was necessary to thaw the roads with coke-fires before pipes could be laid. The cold was so intense that the author anticipated tronble before the summer arrived; but the main had been found perfectly satisfactory. As appeared from the second portion of his paper, the gas was used principally for technical purposes—*i.e.*, for the production of heat—the plant therefore worked only in daytime, and the gas was not carbnretted. A good quality of furnace coke obtained from Upper Silesia was gasified. It contained abont 90 per cent. of carbon and very little slag. Its calorific power was about 13,000 B.Th.U. per lb. The make of gas was about 102,000 cubic feet per ton; and its calorific value ranged between 270 and 280 B.Th.U. per cubic foot. A certain proportion of the make was used for the production of light; and, indeed, the anthor had succeeded in employing the blue water gas in inverted gas-burners just as if it were coal gas. The burners used afforded a light of abont 60 Hefners from a consumption of 100 litres per hour (about 15·5-candle power per cnbic foot). He had also effected some minor modifications in the ordinary coal-gas cooking-stove, so that it was no longer neccssary to burn twice as much water gas as coal gas for any given pnrpose.

Water Gas and the Glass Industry.

The second portion of Herr Reitmayer's communication was taken up with a description of the Bohemian glass indnstry, and the manner in which he had succeeded in inducing its members to adopt the use of water gas. The small glass articles, such as imitation diamonds, and other trinkets, glass "pearls" (some of which are silvered or gilt inside), bnttons, hat pins, cigar holders, and the like that are exported all over the world, and are usually said to be made in Gablonz, are not as a matter of fact manufactured in that town, but are made by the cottagers in the surrounding hamlets which nestle amid the mountain valleys of the Riesengebirge. In former times the whole of the countryside was dotted with smoky chimneys belonging to the small furnaces where the glass was melted. The living and working rooms in these villages were not built alongside a street, but on the steep sides of the mountains in immediate proximity to tiny waterfalls. The waterfalls were used to drive the grinding stones on which the glass objects were finished and polished. In many

cases, indeed, the cottages had no chimneys at all for the combustion products of their fires—the only ventilation being provided by a skylight in the roof. Sanitary and social considerations were almost wholly neglected. Many of the glass objects for which the neighbourhood is famous—for instance the so-called "pearls"—were made from glass tubes; a suitable length of tube being heated, pressed between moulds, and submitted to air pressure from the inside. The glass was then cut off, gilt or silvered on the interior surface when so desired, mounted on threads, and sold in strings. The magnitude of this industry may be gauged from the fact that one particular house of business in the neighbourhood of Gablonz has been in the habit of purchasing fine gold to the value of £60,000 a year for the mere purpose of gilding the inside of the pearls.

Numerous experiments have been carried out to substitute some more efficient form of heating for the old-fashioned fire. Trials have been made with air gas, benzoline, and acetylene; but all have proved abortive, perhaps because the conditions of manufacture were not thoroughly understood and the burners employed were not suitable. The complaints have always been that the colours of the glass articles have been injured. On the other hand, one particular factory in the district has been using water gas for many years in considerable quantities. To some extent, therefore, the glass makers were aware that water gas would not affect the tints of the glass; and in erecting his plant Herr Reitmayer accordingly did not find so much difficulty in obtaining consumers among the conservative population as he otherwise would have had.

As before mentioned, the water-gas installation especially referred to by Herr Reitmayer was erected in the village of Wiesenthal; a second plant is being built at Morchenstern; and a third is to be put up at Josefsthal during the present summer. One other difficulty remained to be overcome in persuading the members of the glass-blowing industry to adopt water gas in place of their customary fires, inasmuch as the glass-blowing is performed with the aid of a blow-pipe flame. The great expense and engineering difficulties encountered in laying the gas-main through the rocky soil of the district rendered it inexpedient to provide a second for the supply of air under pressure from a central plant. The small blower who worked in his own home was therefore left to employ a bellows; but as those who worked on a larger scale required something more efficient, a 10 H.P. gas-engine was laid down to drive a dynamo—current being distributed over the district and delivered to small electric motors of $\frac{1}{4}$, $\frac{1}{2}$, and 1 H.P. in size, so as to afford a mechanical blast where required. In order to simplify the payment for the gas and air, the people who used the latter were charged an additional sum of (approximately) 1s. per 1000 cubic feet of gas, to cover the cost of the air consumed with it.

During the first month of its activity, the water-gas plant at Wiesenthal supplied about 35,000 cubic feet of gas; the consumption growing so rapidly that by the end of the first year it had reached ten times this figure. There were, said the speaker, more than 5000 glass-blowers living in the neighbourhood of Morchenstern and Josefsthal who would probably abandon their old fires in favour of water gas as soon as the new installations were ready.

The Awards in the Tar-Spreading Trials.

The Judges' Committee appointed by the Roads Improvement Association to carry out the competitions for the best tar-spreading machine and the best preparation of tar for road purposes have made their awards as follows: Competition for the best tar-spreading machine, first prize, 100 guineas and the Association's gold medal, to Thomas Aitken, of Cupar, Fife, for Aitken's Patent Pneumatic Tar-Sprayer; second prize, 50 guineas and the Association's silver medal, to Tarspra Limited, for their 700 gallon "Tarspra" (patent) Thorneycroft motor van. Competition for the best preparation of tar for road purposes, first prize, the Ballymena Woollen Factory Company's 100 guinea trophy and the Association's gold medal, to Messrs. R. S. Clare and Co., Limited, of Liverpool, for Clare's patent tar compo. These tests, it may be remembered, were carried out from May 22 to 24 and on May 27 last, on certain roads in Middlesex and Berkshire, and were noticed in the "JOURNAL" at the time. Since these dates the roads have been kept under constant observation; and, durability being an important consideration, it has not been possible to make the awards until the present time. The cost of the trials was borne by the Royal Automobile Club and the Motor Union of Great Britain and Ireland.

"Water-Works Directory and Statistics."—We have received from Messrs. Hazell, Watson, and Viney, Limited, a new issue of this work, for the year 1907-8. It is the twenty-seventh edition of the Directory; and it was much needed, as its immediate predecessor appeared in 1903. The Editor states in his preface that "every effort has been made to bring the volume right up to date, and to give the fullest and most reliable information obtainable." The Association of Water Engineers have given their support and assistance in the preparation of the volume, which contains a much larger amount of information than was to be found in previous issues. The list of Associations and the index of officials are again included. The price of the volume is 10s. 6d. net.

REGISTER OF PATENTS.

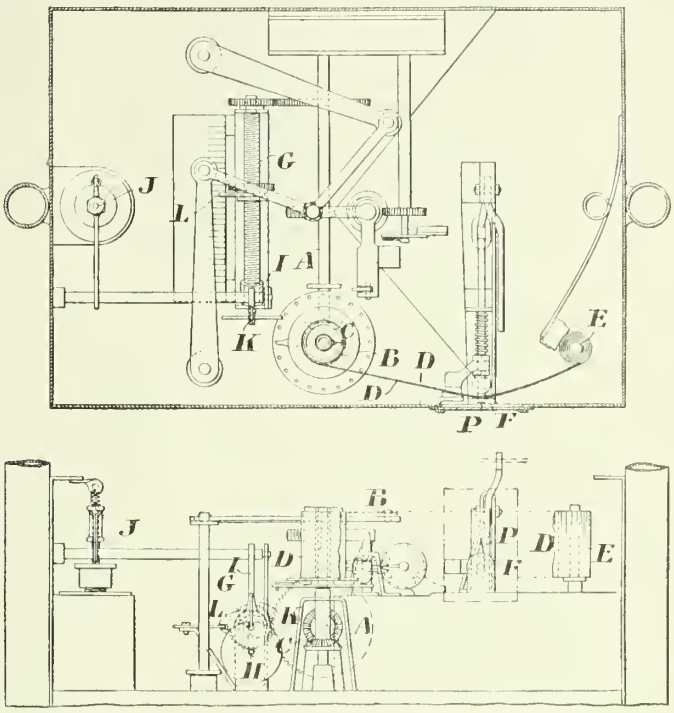
Gas-Meters.

GUNNING, J., of Bournemouth, and HANSFORD, J., of Portland.

No. 16,189; July 17, 1906.

This invention relates more particularly to indicating and recording devices of meters, so that not only the consumption of gas but the value thereof is indicated on a strip of paper bearing a scale of quantities and corresponding values, which is caused to move past an inspection window in the meter frame or index.

The recording apparatus, which may itself be considered as constituting a prepayment device for a meter, may also be combined with any suitable form of ordinary prepayment mechanism—for example, as shown in the engraving.



Gunning and Hansford's Meter-Recording Device.

The shaft A is driven through reducing gear from the ordinary meter mechanism, and drives the spindle of a drum B through bevel gear C. The strip of paper D, bearing a scale of quantities (with or without a corresponding scale of values), is wound on the drum and off the parallel spindle or drum E as the shaft is revolved—the tape speed being proportional to the rate of gas consumption. A friction brake is applied to the tape or spindle to keep the tape taut. The tape passes in front of a spring-urged punch F, which is normally retracted by the displacement of a bell crank lever or equivalent device by the lid or door which gives access to the apparatus, and the opening of which releases the punch and allows it to shoot forward and punch a hole in, or otherwise mark, the strip. Usually the strips would be in duplicate; and the rear strip would (by the action of the marking device on opening the casing) be stamped with the number of the meter or other identification mark, by a rubber stamp carried or actuated by the punch. The rear strip would be taken by the supplier's agent, and the front strip left with the consumer as a record of the quantity consumed and to be paid for. As one end of the strip D is attached to the spindle E, the supply of gas will be cut off automatically by the stopping of the mechanism when the strip is completely unwound, but the end remains attached to the spindle. In order to call attention to the approaching exhaustion of the record strip, the latter portion of it might be coloured red or the scale be printed in a distinguishing colour.

The supply of gas may be arranged to be cut off by the automatic closure of a valve, by any suitable known means, on the consumption of a predetermined quantity of gas. For this purpose, according to one well-known device, in which a traversing pinion is caused to actuate a supply valve through a system of levers, the spindle A is geared with a screw-threaded spindle G, on which is mounted a spur wheel in mesh with a long pinion H ranged parallel with the spindle. The rotation of the spindle consequent on the consumption of gas traverses the wheel, which is guided by the teeth of the pinion H to move axially alon gits spindle, until it encounters and displaces one arm I of a bell crank lever, the other arm of which is connected with the spindle J of the cut-off valve, which is normally held open by a spring. A detent pin K, carried by the bell-crank lever, engages a notch in the axle of the pinion H, or in a disc secured to it, to prevent any rotation of the pinion while the valve is open. The action of closing the valve also disengages the detent, and allows the pinion, and consequently the gear-wheel, to be rotated by a suitable key applied to the pinion spindle—thus enabling the wheel to be set to any desired position on the spindle, and determine the quantity of gas which may pass through the meter before the cut-off valve is automatically closed.

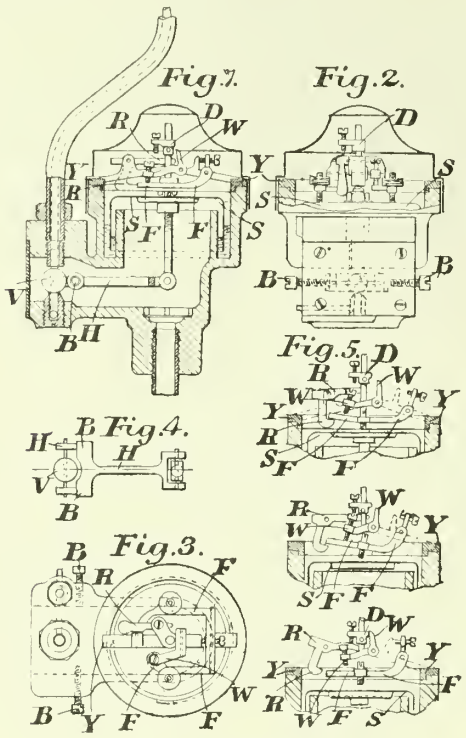
Lighting Gas from a Distance.

BOULT, A. J.; a communication from EDUARD ZICKWOLFF, of Siegen, Germany.

No. 16,454; July 20, 1906.

This invention relates to gas-lighting apparatus of the class in which a gasholder bell is subjected to variations of pressure so as to alternately

open one gas-conduit and close another—a lever with unequal arms being employed to increase the relatively weak action of the bell, so that the conduits are opened and closed with increased force.



Zickwolff's Gas-Lamp Lighter.

Fig. 1 is a section, fig. 2 an elevation, and fig. 3 a plan of the apparatus referred to. Fig. 4 is a closing lever with unequal arms, provided with a hall valve, and fig. 5 shows the stopping and disengaging device in three different positions.

The upper portion of the casing is a receptacle intended to receive the bell S with its closing liquid—mercury. In the bottom portion, between the points B, is mounted an easily swinging lever with unequal arms H, and also valve-seats for the gas-pipes. The small arm of the lever being bifurcated, forms a support for a ball-valve V, which closes the gas-pipes. The long arm of the lever H being hinged to the rod of the gas-holder bell, the opening and closing of the valve-seats take place with a force which is dependent on the proportion between the two arms of the lever, and on the force the floating bell develops during its ascent and descent.

The rod of the gasholder bell engages, by means of a tappet D, with the stopping and disengaging device, the construction of which is as follows: To the arc-shaped bracket Y are hinged: (1) a double lever F, (2) a stop lever W, and (3) a disengaging lever R. Each arm of the lever F is provided with a set screw, and the junction piece of the two arms with a regulating screw. The object of the latter is to bring the lever into the desired position against the finger of the lever, in order to enable it to come into engagement at the desired moment and to hold the lever in its raised position for a short time. The regulating screws have for their object to stop the upward movement of the gasholder bell after its first stage has been accomplished. The stop lever W is a bell-crank lever, the horizontal arm of which is also provided with a set-screw. The tappet D of the bell-rod is also provided with a set-screw. The screws on F are adjusted in such manner that in the position of rest of the apparatus they are a short distance from it. The weight of the bell is so calculated that the normal pressure of the gas cannot raise it; and it is necessary to produce an increase of pressure sufficient to cause it to strike against the screws, but not sufficient to enable it to raise the lever arms F (weighted to any desired extent). The screws constitute, therefore, an obstacle which limits the first stage of the travel of the gasholder bell.

On the bell being caused to rise as stated, the stop lever W falls by gravity into a recess of the tappet D, and the set-screw of the lever comes into contact with the lever F. Increase of pressure intentionally produced lasts only for a short time; the pressure of the gas in the pipe soon returning to its normal condition. Consequently, the bell descends again so long as the stopping device described has not been operated by the engagement of the lever W. Beginning with this moment, the pressure of the gas can descend to a certain minimum without affecting the bell. In order now to counteract the stopping action which has taken place, it is necessary to produce in the gas-pipes a pressure sufficiently strong to raise the bell and the lever F with the balance weights arranged as desired.

During this second stage of the upward movement of the bell, the stop lever or pawl W, owing to the contact of its set-screw with the lever F, is moved away from the tappet D, and the lever R engages, by means of its heel, with the raised lever F. When the pressure wave which has disengaged the stopping device has ceased, the bell can freely descend to its position of rest. During the descent the lever W cannot engage again under the tappet D, as the lever F is held in its raised position by the heel of the lever R, the result of which is that the lever W is held away from the tappet D. Disengagement of the lever F then takes place only when the tappet D has descended sufficiently low to make it impossible for the lever W to get into engagement.

The working of the apparatus is as follows: In the position of rest of the apparatus, the gasholder bell is in its lowest position, and the conduit leading to the illuminating flame is, therefore, held closed by the lever H connected to the ball-valve V; while the conduit going to the bye-pass flame is open. If it is desired to light the main flame, it will be necessary to produce an increase of pressure sufficient to raise the bell up to the first obstacle of the set-screws, but without overcoming it. On the bell being thus raised, the conduits going to the lighting flame will open and light the flame, while those going to the bye-pass flame will be closed by the ball V dropping on its seat.

In order to allow further movement of the bell S and lever H, the latter is not rigidly connected to the ball V, which is supported in a clearance hole, slot, or the like, in the forked end of the lever, so that the opening in it is closed with a pressure due to the weight of the ball, while the end of the lever is free to continue the movement in a downward direction. As now the bell has been stopped in the raised position, the lowering of the pressure of the gas, even to a minimum, and the variations of pressure in the gas-conduits cannot affect the apparatus. In order to give as large a play as possible to these variations of pressure, the patentee prefers to make the bell sufficiently heavy to prevent it from being raised, except by a comparatively strong pressure, and also to reinforce by weights the obstacle limiting the first stage of the movement of the bell, to such an extent that it should be necessary to produce in the gas-pipe a considerable increase of the pressure capable of raising the bell up to that obstacle in order to operate the bell so as to overcome it. This second large increase of pressure brings about a disengagement of the system, and the bell freely descends again, closing the conduits going to the lighting flame, and opening those to the bye-pass flame, which is then again ignited.

The weights on the levers F can be arranged so that a certain number of burners would be more charged than others. In this case, it is necessary to have another increase of pressure, in order to extinguish the burners. The burners already extinguished will then burn only a little time.

The desired increase of pressure can be brought about (the patentee remarks) by the gas-works at any hour, according to requirements, and it will not be permanent, but would "be obtained merely by a passing wave of pressure in the network of pipes."

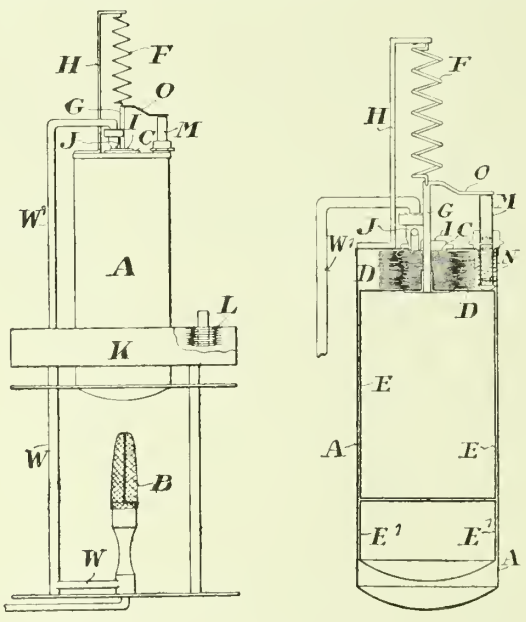
Compressing Gas or Air for Lamps.

Cook, E. S., of South Lambeth, S.W., and Chipperfield, W. H., of St. Pancras, N.W.

No. 20,521; Sept. 15, 1906.

This is an apparatus for the compression of gas or air for lamps of the type wherein "the heat given off by the burner is converted into mechanical energy for the compression of air or gas for use at the burner."

The illustrations show an elevation of the lamp with the compressing apparatus fitted to it; also a sectional elevation of the compressor on an enlarged scale.



Cook and Chipperfield's Pressure-Raising Gas-Lamp.

The hollow metal body A is placed above the burner B, so that the heat will impinge upon the lower portion of it. The vessel A has an opening C formed centrally in its upper end, to the boundary of which is attached a hollow flexible, extensible, and compressible metallic body D (preferably annular in form), to which is attached an inner hollow body E composed, preferably, of metal, and free to move within the outer vessel. The inner body is constructed in two parts E E1 for the purpose of reducing the conductivity, thereby keeping the variation in temperature greater at each end than would be the case in an inner body or displacer made in one piece. Or it may have a dividing diaphragm about its centre. Its weight is held in suspension by a spring F, through the medium of the rod G; the upper end of the spring being attached to a rod H.

The central opening in the upper end of the outer body is closed by a cover I, to which are connected inlet and outlet valves. The outlet valve J communicates by a pipe W1 with a receiver K, provided at L (which is a flexible metallic body, weighted to a predetermined pressure, and open at its upper end to the atmosphere) with an arrangement for equalizing the pressure of the gas or air within, which is then conducted through the pipe W to the burner for use as required. The inlet valve J1 communicates from the gas supply or the atmosphere into the body D.

The lower end of the rod G is attached to the top of the upper inner chamber E; the rod passing up through the cover I and being capable of reciprocating movement. A cylindrical slide valve M is attached to

the outer vessel A, and is provided with ports open to the atmosphere at each end of the stroke. An arm O, mounted on the connecting rod G and moving with it, extends above the slide valve M so as to ensure its downward movement.

The application of heat to the lower end of the apparatus expands the air in the outer chamber A, thereby increasing its pressure, and causing the inner flexible metal body D to contract, and carry with it the hollow body E, thereby raising the valve M. This movement continues until the upper ports in the valve M are open to the atmosphere, when the expanded air in the outer chamber will be allowed to escape to the atmosphere through the lower ports. The pressure in the outer vessel having been thereby reduced, the vessels E and E^1 commence to fall by gravity—thereby causing the expanded air at the bottom and heated end of the chamber to pass upward between the inner and outer chambers to the cooler ends. Here contraction takes place; creating a partial vacuum by which the further downward travel of the chamber is continued, until the lower ports in the valve M (which has been caused to follow the movement of the inner chamber by the action of the spring) again open communication between the outer chamber and the atmosphere through the open upper end, and admit a fresh supply of air from the atmosphere to take the place of that previously released. These movements and operations recur in regular cyclical order.

The motion imparted to the inner flexible metal body D causes it to act as a pump, by which gas from the gas supply, or air from the atmosphere, will be drawn into it through the valve J^1, and expelled through the outlet valve J, at an increased pressure, to the receiver K.

High-Pressure and other Bunsen Burners.

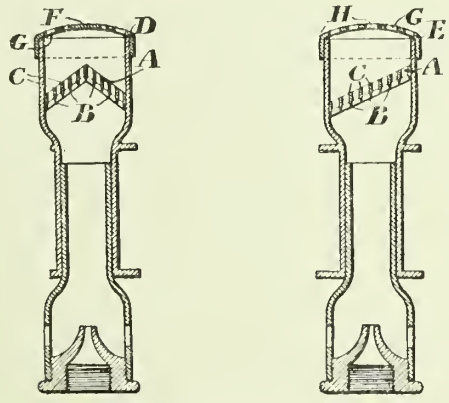
Wouwermans, P. von, and the Gasspar Unternehmung nach System Wouwermans, Halbmayr and Co., of Vienna.

No. 20,643; Sept. 17, 1906.

This invention relates to improvements in the bunsen burner described in patent No. 8544 of 1906; and it is intended to increase the effect of it as much as possible by giving the distributing grate or distributor such a shape that it "will offer the largest free section with the least resistance to the entering gas;" secondly, to make the size of the holes in the cap of the burner to correspond with the pressure of the gas.

This "largest free section available with the least resistance to the entering gas" is obtained by making the distributor (containing the small channels) conical, or in the shape of a double sloping roof, or by simply arranging it at an incline, at the same time sharpening the channel walls, which must be kept as thin as possible on their lower ends, so that they will not offer resistance to the entering gas, but rather act to cut the current.

With regard to the burner cap, it has been found that, in the case of high pressure, a better result is obtained if the holes are limited to two or three outer rows; the holes of the inner rows being of a smaller diameter than those of the outer row, and the centre part being a blank. In case of low pressure, it is, however, preferable to perforate the centre portion as well, and make the holes of the centre part of the same diameter as those of the outer rows. At the same time it is advantageous to make the cap smaller in diameter.



An Austrian High-Pressure Burner.

The illustration shows one burner, the distributing grating in the head of which is constructed in the shape of a double sloping roof, and another where the grating is arranged at an incline.

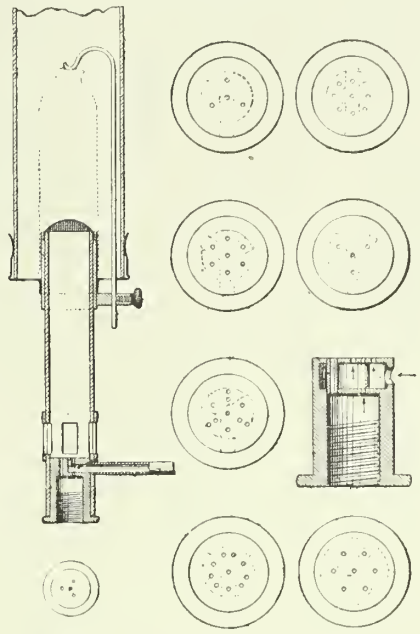
The head of the burner first shown is provided with a distributing grating or distributor A, the lower edges B of the walls C of which are bevelled at both sides, so as to present cutting edges to the current of gas and air. In this instance the distributor is constructed in the shape of a double sloping roof. In the other, the distributor A is constructed in the shape of a shed-roof, and with walls C having their lower edges bevelled. The first burner is provided with a cap D, adapted for high gas-pressure, having two circumferential rows of holes G; the holes of the inner row being of smaller width than those of the outer one. The centre portion F of the cap is entirely without holes. The second burner is provided with a cap E adapted for low gas-pressure, with the centre portion of the cap perforated with holes H, or about the same diameter as the holes G of the outer row.

Compressed Air-Burner for Gas-Lighting Purposes.

Murinick, A., of St. Petersburg.

No. 22,216; Oct. 8, 1906.

This invention has reference to an arrangement wherein jets of gas and compressed air issue into the mixing-chamber of a burner of the bunsen type, constructed in one piece. Its passages and outlets are so arranged that the gas-jets issuing through certain of the passages may be enveloped by air both internally and externally; the internal supply of air being delivered to the burner under pressure, while the external supply is induced through apertures in a bunsen tube in connection with which the burner is intended to be used.



Murinick's Compressed-Air Gas-Burner.

The burner shown "admits of many variations and modifications in the arrangement and combination of the outflow apertures for the gas and compressed air." There is, first of all, a central vertical section through the burner with its gas and air distributing means; a plan of the air and gas inlet aperture; and then a series of different forms of construction for the arrangement of one or more air outlet apertures. Lastly, there is a central vertical section through a special form of distributing means, and a plan of the same device.

The burner-tube is provided, as usual, with a perforated chimney gallery, and is mounted on an air and gas distributing body, which, in the present case, is in the form of a cap. Above it, the tube is formed with several air-inlet apertures, which can be opened more or less by a slide. The upper closed portion of the cap is formed with a lateral passage extending to the side, and to which the inlet tube for the compressed air is connected. A central fine hole forms a nozzle through which the compressed air is fed to the mixing-chamber of the burner-tube. Arranged symmetrically around this nozzle are a series of holes through which the gas-chamber of the cap communicates with the mixing-chamber.

The stream of compressed air, on being admitted, intimately mixes with the streams of gas; and by the energy of the issuing gaseous mixture more air is drawn in through the aperture shown, and mixes with the stream of gas. Thus the gas is enveloped between a supply of compressed air and a supply of air induced from the atmosphere surrounding the bunsen tube.

In the subsidiary forms of the burner, further distribution of the compressed air is attained. In addition to the passage already referred to, there are provided branch passages formed with symmetrically arranged holes for the compressed air. By increasing or reducing the number of branch passages and the holes therein, "a very wide range in the supply or distribution of the air can be effected."

In the modification of the distributing member, the upper part containing the air and gas passages is made in the form of a socket or chamber to which the air is fed through a lateral hole. In this way, independent distribution of the air-holes is rendered possible. The gas is here supplied through a series of tubes extending through the socket or chamber of the body.

Prepayment Gas-Meters.

Morrison, A. C., of North Brunswick, Victoria.

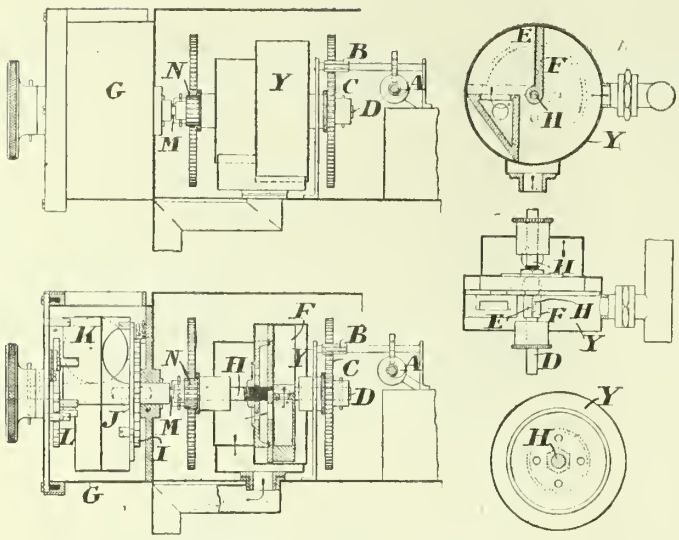
No. 25,873; Nov. 15, 1906.

This prepayment gas-meter is of the kind in which a rotating wing moved by the coin-operated mechanism, co-acts with a rotating seat moved by the paying-out mechanism of the meter or *vice versâ*.

The paying-out shaft of the meter (see p. 516) is geared through a screw A, pinion B, and wheel C, to a shaft D, on which is mounted a valve E—a radial metal wing F carrying a leather valve-face. A valve-seat is also mounted on a shaft H, supported partly within a socket on the shaft D and provided with a spur-wheel arranged to mesh with a pinion on the coin-operated shaft M. Thus when the shaft is rotated for a short distance, the valve-seat is moved away from engagement with the wing-valve F, and the paying-out shaft of the meter is free to move. In consequence, gas may be taken until the shaft has once more caused the valve F to close.

On rotating the valve-seat away from the wing-valve F, gas flows from the meter into the space Y, connected with the measuring-out apparatus. The passage of gas through the meter causes the rotation of the paying-out shaft, or, conveniently, the usual indicator shaft of the meter to which the screw A is connected, and thereby effects the rotation of the valve F towards its seat. The gas continues to flow till the valve once more engages with its seat, thus stopping the flow of gas. The quantity of gas given for each coin may be altered by varying the relative displacement given to the valve and valve-seat at each insertion of a coin.

The mechanism for effecting the displacement of the valve-seat (the coin-operated prepayment device) is constructed as follows: The pinion



Morrison's Prepayment Gas-Meter.

N, mounted on the prepayment shaft M, is arranged within the meter case so that the prepayment shaft passes through the case into a preferably cylindrical chamber G, in which the coin-mechanism is placed. Mounted so as to rotate with the shaft M, and within this coin-mechanism case, is a ratchet-wheel I, having a fixed detent, so as to limit its rotation to one direction only. The end of the shaft is drilled centrally so as to accommodate one side of a pivot carrying a segmental plate J. On the side of this plate (adjacent to the ratchet-wheel I) is a pawl, pressed by a spring or the like so as to cause it to engage with the teeth of the ratchet-wheel I. On the opposite side of the plate J are two pins, arranged at different radii—one adapted to engage with a coin when inserted, while the other is arranged to engage with a permanent part of the coin-pocket. The two pins are arranged at an angle adjustable for convenience in varying the price of the gas. In the form illustrated, this adjustability is effected by providing a number of holes arranged in a circle, and into which a pin, which engages with the coin, may be inserted.

The coin-pocket K shown is adapted to be rotated by the operating handle. One side of the pocket is adjacent to the segmental plate J, and is cut away so as to allow free passage of the pin, which engages with the coin only when a coin is inserted. When, however, a coin is inserted in the position shown, the rotation of the coin-pocket by the operating handle causes the rotation of the segmental plate J, and thereby effects the rotation of the prepayment shaft. A pin engages with the coin-pocket on its backward rotation, and thereby brings the segmental plate J back into a position where, on the insertion of a further coin, another rotation will be given to the shaft M.

The side of the coin-pocket remote from the segmental plate has a slot arranged to clear a number of pairs of pins projecting from a ratchet-wheel, mounted so as to rotate freely on the shaft to which the operating handle is attached. This shaft passes through the cover of the coin mechanism case, and an operating handle is fixed on it. On the inside face of the cover there are mounted two stop pins, for adjusting the amount of rotation given to the coin-pocket, and causing it to stop exactly opposite the inlet and outlet coin-slots in the casing. Two coin-slots are provided in the casing—one for the insertion of the coin, the other for the rejection of the coin into a suitable storage chamber. On the inner face of the cover, there is also mounted a pawl, adapted to engage with the ratchet-wheel L, carrying a pair of pins. By this means the rotation of the ratchet-wheel is limited to one direction. When a coin is inserted in the pocket K, it passes between one of the pairs of pins and thus couples the ratchet-wheel to the coin-pocket; while the ratchet-wheel, co-acting with the pawl arranged on the inner face of the fixed cover, can only rotate in one direction. By this means backward rotation of the coin-pocket, after a coin has been inserted, is rendered impossible.

Washing Gases.

Bachman, F. E., of Port Henry, New York.

No. 28,148; Dec. 10, 1906.

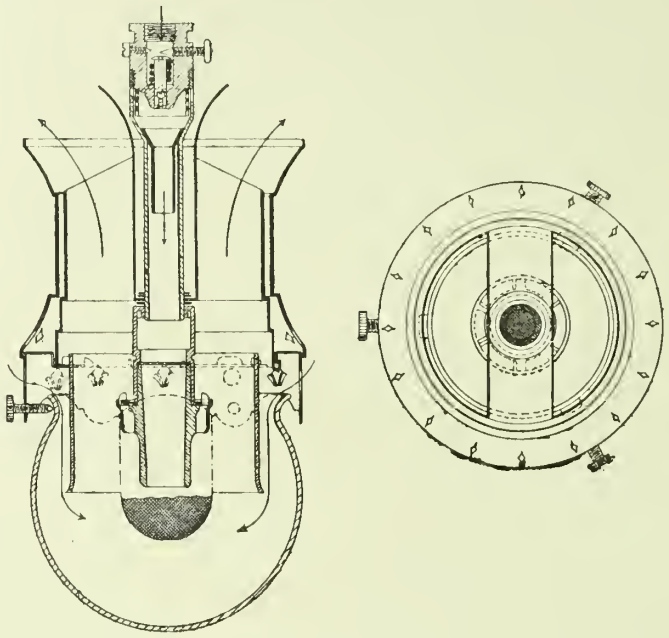
This is an apparatus for separating dust from (more especially) furnace gases by throwing it outwardly, by centrifugal force, against a wall, from which it is washed down without substantially spraying the gas. With this object the gas is given a rotatory path; spray pipes being used for washing the deposited dust from the casing on which it has been deposited by centrifugal action. The invention further consists in giving the gas a spiral path; the spray pipes being used to wash the dust both from the spiral shelf and from the casing.

Inverted Incandescent Gas-Lamps.

Graetz, M., of Berlin.

No. 7047; March 23, 1907.

This inverted incandescent gas-lamp works at low pressure. For obtaining in such lamps a high lighting power, the patentee points out, the gas conducted to the mantle has to be mixed largely with fresh air; but difficulties have hitherto arisen from using gas under low pressure, owing to the heating of the mixing-tube. The temperature of the mixing-tube is gradually increased and then constantly maintained; and thereby "the energy of the gas is greatly diminished, so that fresh air cannot be induced in such quantities as is required for good combustion; the lighting power is thereby decreased; the flame begins to soot; and, furthermore, the flame flashes-back." It is the heating of the mixing-tube that causes these defects; and it has been proposed to make the lower part of the tube of non-conducting material—for instance, glass—and for the purpose of deflecting the hot combustion gases, at the upper end of the insulator, a protecting cone has been arranged. It is also well known to make the mixing-tube along its whole extension in the form of a heat insulator. A constant improvement, however, has not been obtained from these provisions; the drawbacks being "due to the fact that the burner is considerably heated after a certain time, for the hot combustion gases ascending outside the mixing-tube or striking the same, effect gradually a considerable heating of the tube, and this heating is constantly maintained." The insertion of non-conducting materials has only the effect of retarding the increase of temperature till its maximum point is reached; but it does not prevent the heat from reaching the mixing-tube.



Another "Graetzin" Lamp.

It is to overcome these drawbacks that the present invention was designed. As shown, a non-conducting mixing-tube is used, and at the same time provision is made to remove the heat collection and storage respectively, as occurring in the above-mentioned devices. For obtaining the latter, the heat of the mixing-tube is continuously carried away; and the mixing-tube is so arranged relatively to the remaining burner parts that the hot combustion gases are absolutely prevented from coming in contact with the former, and the hot gases are exhausted so as to be out of contact with the mixing-tube, and so that the latter is constantly surrounded and ventilated by fresh air.

The mixing-tube can be made in several different ways. The non-conducting material can be glass, porcelain, clay, or magnesia; but also heat non-conducting metal alloys can be used—for instance, argentan, nickelin, constantin, or manganin. Or the mixing-tube can be provided on the inside with a shell of a non-metallic heat non-conductor; or a mantle-tube of heat non-conducting metals can be provided—thus obtaining an air-space which has an insulating effect. However, it is required that the outer air is enabled to constantly carry away heat from the mixing-tube. For increasing the action of the air, the surface of the mixing-tube in contact with the cooling air can be enlarged, by means of radial ribs or corrugations.

Lighting and Extinguishing Gas-Lamps from a Distance.

Himmel, G., of Tuebingen, Germany.

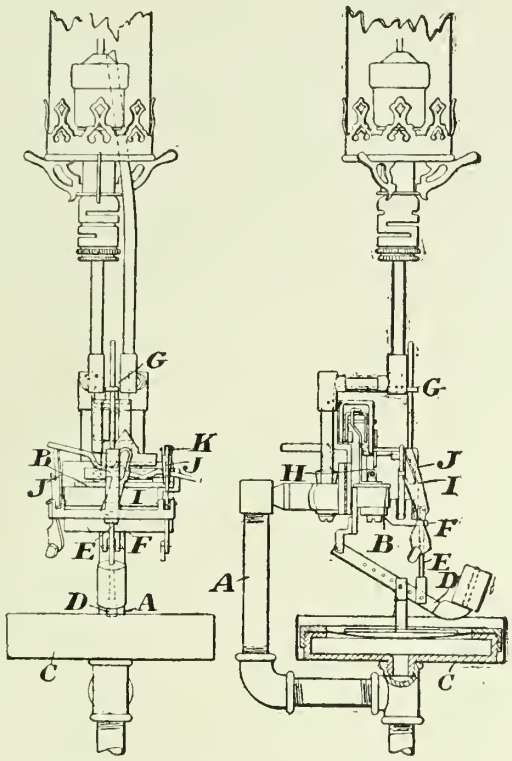
No. 10,237; May 2, 1907.

This is a device for enabling gas-jets to be lighted and extinguished from the gas-works or other central station at any desired time—serially or altogether; being operated by a momentary increase of pressure in the main.

The patentee claims to avoid defects of other similar lighters by a peculiar valve arrangement which is operated by the gas pressure, and by the member regulating the gas supply being compulsorily operated in such a way that "the lighting and extinguishing take place only in the desired manner, and lighting in series may be suitably performed." A further advantage is also said to be attained—that is, by accidentally simultaneously lighting or extinguishing a large number of jets, a variation in the pressure is produced in the pipe, which causes the directly influenced member to be operated. With a suitable load, this operation does not cause a premature temporary opening and closing of the valve. Finally "the separate parts are easily accessible, and also the entire device is removable, while after its removal the lamp is still adapted to be used in the ordinary way without further alteration."

The apparatus comprises a main burner pipe and a lighting or pilot burner pipe, both fed from one main pipe. The gas flows from the latter by an intermediate pipe A to a distributing head, from which, by means of valve mechanism or a governor, it is conveyed alternately to the main burner and to the pilot burner. Three passages are provided in the head, all of which open into a recess at its surface. A valve B provided with a recess also slides on the head, which recess, according to the position of the valve, connects the passages successively, so that gas may alternately flow to the main burner and to the pilot flame, while, of course, the dimensions must be such that the passage closed is only fully closed when the other is already opened, in order to prevent the extinction of both flames.

A wave of gas pressure is now used for governing or operating the valve B, which pressure (given from a central station) is capable of being regulated. For this object a diaphragm is connected with the main pipe, and is easily and regulatably lifted by the pressure. By means of a disc resting on the diaphragm, a lever D, pivotally and displaceably connected with it, is lifted. A vertically movable rod E is also flexibly mounted on the lever, and is guided, on the one hand, in the arm F, and, on the other hand, in a lug G, while the arm also serves simultaneously as a stop in order to prevent the bar descending too far.



Himmel's Gas-Lamp Lighter and Extinguisher.

The vertical movement produced by the gas pressure is now converted into a horizontal one, and also simultaneously into a turning one. The horizontal movement operates a displacement of the slide valve B. The latter has for this object a connection H, which is provided in the middle with a triangular projection to produce the turning movement. For displacing the slide valve B, the projection has an aperture in which a pin engages, which is carried by an arm I – pivotal on a pin mounted in the arm E. If, then, the arm I be caused to rock, its pin moves the valve B; and this movement is brought about by lifters mounted on pins pivotal on a bridge-piece on the rod E. The lifters are held by weights in a vertical position, and have at their upper ends a hooked jaw J, with which, in rising, they alternately engage beneath a cross bar of the arm I and carry it with them, so that the arm is caused to turn.

Now in order, on the one hand, to prevent the extinguishing of the series of jets, which, when the others are extinguished, may be required still to continue to burn, and, on the other hand, to prevent the latter being lit when the first are extinguished, one of the lifters is provided with a flap or lug pivoted on a pin K. It can be turned upwards, and is also so bent that it pushes past the bar in the upward non-working movement of the lifter and closes the jaw J, while on next descending it remains lying on the bar, and allows its jaw to engage at the next movement upward. In order to allow of this, and also to bring the lifters alternately into engagement, the bridge piece is pivotally arranged by the rod E having a little play at its point of connection with the lever D.

One method of working the arrangement is described (by means of a series of diagrams accompanying the specification) where a lamp is (say) to burn during half the night and another lamp to burn during the entire night, assuming that it is intended to extinguish the first series of jets at twelve o'clock midnight and the other series at five o'clock in the morning.

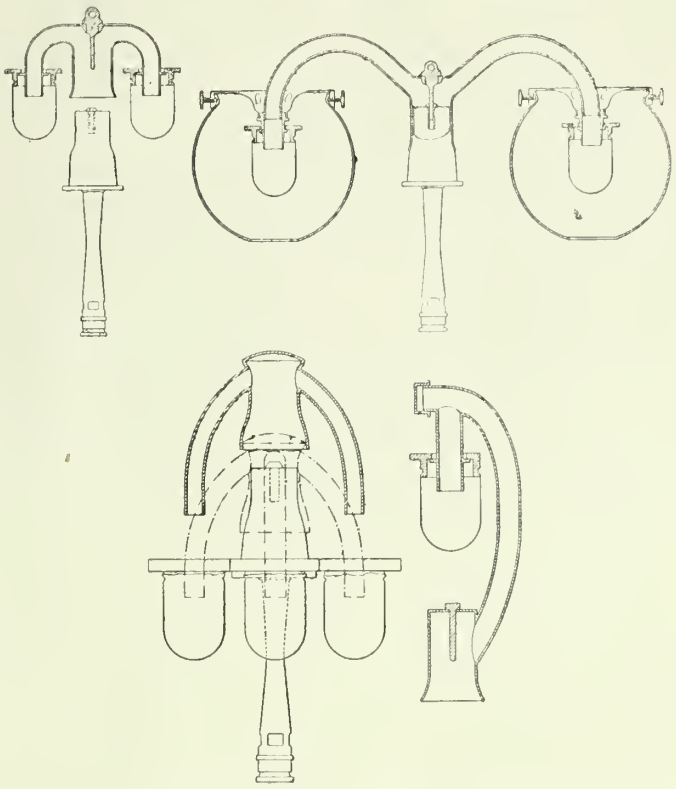
Converting Upright into Inverted Incandescent Gas-Lamps.

Cowan, T. W., of Rotherham.

No. 8936; April 17, 1907.

The inventor provides a chamber or cap (adapted to be passed over the upright burner after the removal of the mantle rod) with an arm or arms opening into the chamber at one end and, at the other end, turned down and carrying, or else constituting an inverted burner. The inverted mantle is carried by supports on the turned-down end, or else is supported by a separate piece resting on the base of the upper part of the upright burner. The chamber or cap is preferably provided with a central internal peg or pin, which engages in the opening for the mantle-rod in the upright burner, and is of such a size that it will slide over the top of the upright burner. Thus this "adapter burner" can be readily applied to, and removed from, any ordinary upright burner.

The illustrations represent different forms of the "adapter burners." First of all there is a Welsbach-Kern burner in elevation and (in vertical section) a two-light "adapter burner" applied to it. Then there is a like arrangement, but with the arms of the "adapter burner" extended so as to take globes or glasses round each mantle. Next the "adapter burner" is shown with a separate mantle-holder supported on the base of the upper part of the upright burner. There is also an "adapter burner" for one mantle only.



Types of Cowan's "Adapter Burner."

APPLICATIONS FOR LETTERS PATENT.

17,450.—Nikiforoff, A., "Treating naphtha and carburetting water gas to obtain aromatic hydrocarbons." July 30.

17,464.—Gasmotoren-Fabrik Deutz, "Internal combustion engines." July 30.

17,566.—Lythgoe, G., "Swivel bye-pass gas-bracket." Aug. 1.

17,575.—Bray, J. W., "Vertical inverted burner." Aug. 1.

17,632.—Poleschowsky, J., "Gas-burners." Aug. 1.

17,637.—Ewart, G. H., "Water-heaters." Aug. 2.

17,755.—Amor, G. W., "Condensers for gas, &c." Aug. 3.

17,786.—Castleman, F. M., and Stewarts & Lloyds, Limited, "Valves." Aug. 3.

17,802.—Lessing, G., "Process applied to coke-ovens securing bye-products, for the treatment of gases and vapours rising in the ascending-pipes between coking periods." Aug. 6.

17,819.—Booth, H. S., "Internal-combustion engines." Aug. 6.

17,840.—Russell, R. J., "Gas lamps and burners." Aug. 6.

17,858.—Koppers, H., "Retort-furnaces for manufacturing gas and coke." Aug. 6.

17,875.—Glover, T., "Retort-settings for the production of illuminating and other gas, coke, and other residuals." Aug. 6.

17,889.—Reeser, H., and Wampach, G., "Mantles for incandescent gas-burners." Aug. 6.

17,912.—Wilke, C., and The Simon-Carves Bye-Product Coke-Oven Construction and Working Company, Ltd., "Coke-waggons." Aug. 7.

17,913.—Wilke, C., and The Simon-Carves Bye-Product Coke-Oven Construction and Working Company, Ltd., "Quenching coke." Aug. 7.

17,929.—Junkers, H., "Gas cooking apparatus." Aug. 7.

17,932.—Hinselmann, W., "Conveying coal on inclined lines." Aug. 7.

17,956.—Gallagher, R. W., "Billing machines for meters." Aug. 7.

17,984—Schroer, W., "Conveyor spirals." Aug. 7.

17,986.—Carroll, L. D., "Water-gas apparatus." Aug. 7.

17,987.—Ainsworth, J., "Gas-generating apparatus." Aug. 7.

17,991.—Ernst, E. U. G., "Production of lighting gas." Aug. 7.

17,998.—Sherwood, I., "Suspending incandescent gas-mantles." Aug. 7.

18,010.—Adams, M. J., "Gas-generating apparatus." Aug. 8.

18,025.—Oakman, R. N., "Opening and closing gas-valves at a distance." Aug. 8.

18,026.—Loomis, B., and Pettibone, H., "Making and delivering mixed gases to gas-engines." Aug. 8.

18,056.—Holland, H., "Carburettors." Aug. 8.

18,098.—Habicht, P. & C., "Internal-combustion engines." Aug. 9.

18,118.—Parker, T., "Distillation of carbonaceous substances." Aug. 9.

18,135.—Radcliffe, J., "Treatment of alkaline effluents." Aug. 10.

18,139.—Cliburn, A. L. & F. P., and Thompson, G., "Clip fastenings for pipes." Aug. 10.

18,141.—Jones, A. O., "Coke-ovens." Aug. 10.

18,153.—Wilton, G., "Treatment of producer gas, water gas, or intermediate gases, or other poor gases, with particular reference to the firing of coke-ovens." Aug. 10.

18,156.—Schirp, H., "Carbonizing plants." Aug. 10.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Application of the Sliding Scale and Auction Clauses to Gas Companies.

SIR,—Your very interesting articles headed "The Centenary of Gas Lighting," recalling the early history of our useful industry, are worthy, as appears to be suggested, of republication in book form. That being so, I should be glad of the opportunity of a few words of explanation on the subject of the sliding-scale which is dealt with in the last number of the "JOURNAL," so that the proposed republication may be as accurate as possible.

The writer says: "London cannot claim to be the originator of the sliding-scale"—meaning, of course, its application to gas companies; for the sliding-scale probably originated in the remote and unknown past. The so-called sliding-scale, applied to the Sheffield and West Ham Gas Companies, and I believe to one or two others, is very imperfect, limited in its action, and has long been quite inoperative. Its introduction was probably due to the desire to neutralize the limitation of the dividend to 7 per cent. on new capital. In the West Ham Gas Company's case, the new capital was limited to 7 per cent. dividend so long as the price of gas was not reduced below 4s. 6d., with the proviso that at a 4s. 3d. price the dividend payable should be 8 per cent., at a 4s. price, 9 per cent., and at a 3s. 9d. price, 10 per cent. There this imperfect and limited sliding-scale stopped, and nothing further has been done with it.

Whether it gave me the idea for the introduction of a complete sliding-scale, I do not remember; but my claim is that I was the originator of the application of the up-and-down complete sliding-scale to gas companies, whereby gas dividends, following reductions or increases in the price of gas, should rise above or fall below the standard rates fixed in Acts of Parliament. The controllers of the gas industry almost universally ridiculed my proposal that dividends should be allowed to rise above 10 per cent. as the price of gas was reduced. They said Parliament would never listen to it; and that even if Parliament agreed, so soon as any gas company increased their dividend above 10 per cent. there would be another public outcry and agitation of the kind that in those days had become chronic. Instead of that came reduced prices, increased dividends, and—best of all—a lasting peace.

A word about the auction clauses. They were not mentioned in 1875 before Mr. Forster's Committee, and, I believe, not even thought of; but probably the proceedings before that Committee led the late Mr. Farrer (afterwards Lord Farrer), then the Secretary to the Board of Trade and the author of the auction clauses, to introduce them. He did so in the Gaslight and South Metropolitan Companies' Bills of 1876; and in 1877 he induced Parliament to adopt the auction clauses as a Standing Order. Mr. Farrer said that henceforth gas shareholders should not have allotments of new gas capital at par, whereby they obtained high premiums for doing nothing, to the disadvantage of the public. The late Mr. C. H. Parkes, the Board of Trade Official Auditor of the London Gas Companies' accounts, told me that he had never liked my proposed sliding-scale whereby dividends might be increased above the standard rate until Mr. Farrer proposed the auction clauses. "Then," said Mr. Parkes, "the auction clauses are the proper complement to the sliding-scale; and the two together have my full approval."

Thus combined, they have made gas shareholders and consumers partners—the only really satisfactory settlement of the problem of the supply of public utilities (which must be monopolies, whether they are in the hands of companies or corporations), the advantages of both monopoly and competition being thereby secured. They have given consumers cheaper gas and shareholders higher dividends (upwards of £3,000,000 extra in London alone, according to Mr. Haward of the London County Council). They have saved London at least from a municipal supply of gas. They have provided a safe investment, at a fairly good rate of interest, for the savings of the thrifty; and they have helped more than anything else to bring peace to the gas industry.

Aug. 17, 1907. GEORGE LIVESEY.

Capital Expenditure of Gas Companies and Local Authorities.

SIR,—I did not intend to trouble you further; but may I say that the more these figures are multiplied, and the more one sees of the extent to which they may be criticized, the more do I become convinced that the course taken by me with regard to my evidence was the right one. Your readers, both laymen and experts, must be already sufficiently bewildered; and therefore I will with your permission address myself, as briefly as I can, only to one or two points which appear to me to stand out with the greatest clearness.

In the first place, you say I ought to have explained, by my evidence, the causes which tend to widen the difference between the capital indebtedness of the two classes of undertakings. Perhaps I might have done so; but what, after all, does this amount to? It is a subject upon which much might be said, not always to the advantage of the Companies; and I was ready and willing to answer to the best of my ability any questions that might be put to me by the opposing Counsel backed by experts, whose assistance during the hearing you ignore. Apparently, however, they did not think it worth while to pursue this matter. You also seem to think that it would have been a fairer way of presenting my figures had I given the actual expenditure per million cubic feet sold. To do this I should have had to include on the one side a certain amount of goodwill, owing to additions made to the Local Authorities Returns since 1882. This could have been got over by a comparison of only those undertakings of both kinds included in both the earlier and latest returns; but you were not satisfied with this when I did make it, on the ground that it was not fair to the Companies. The comparison of which apparently you do approve is necessarily incomplete, and could not therefore be accepted as conclusive evidence; while a suspicion of partiality almost invariably attaches to almost any method of selection. By my method these difficulties are avoided; every conceivable circumstance is embraced; and it shows, clearly and simply, the extent to which the local authorities are reducing their capital indebtedness.

Beckenham, Aug. 17, 1907. CHAS. HUNT.

["By my method these difficulties are avoided; every conceivable circumstance is embraced; and it shows, clearly and simply, the extent to which the local authorities are reducing their capital indebtedness"—to also, "by my method," the great disadvantage of those many companies who have been dealing with their capital accounts wisely and well. A great suspicion of unwarranted "partiality" attaches to the rolling up of those companies in the total of 482—composed of all sorts and conditions, working in all sorts and conditions of places—and comparing them with only 270 local authority concerns, many of which are favoured greatly beyond the average gas company undertaking. So many things may exist among the 212 excess undertakings that would act very detrimentally in a comparison; and between the statutory gas companies and the local authorities no really approximate relation does obtain. Of the 270 local authority undertakings, no less than 82 are situated in Lancashire and Yorkshire; and half of the total are found in Cheshire, Derbyshire, Durham, Lancashire, Leicestershire, Nottinghamshire, Staffordshire, Warwickshire, and Yorkshire. Touching our correspondent's point that, if his method of presenting the figures to the Lord Committee was unfair, he was "ready and willing to answer to the best of his ability any questions that might have been put to him by the opposing Counsel backed by experts, whose assistance during the hearing you ignore," Counsel and expert witnesses for the Company were not to know at the time Mr. Hunt gave his evidence that the latter would not have an opportunity of occupying the witness chair, through the Lords Committee being satisfied, on the promoters' case alone, that a case had not been made out for purchase. But this little fling does not absolve of responsibility for deriving a high average by the use of poorly circumstanced concerns, and tarring the whole with the result. However, we understand from our correspondent's present communication that he does not desire to pursue the matter further. But, for our own part, we think it may be useful later on, when time permits, to go into the question with more fulness, to show, with still greater clearness by the use of the returns, that, without making a selection so as to compare like with like, a serious injustice is done to a large number of gas company undertakings by averaging the capital of the whole per million cubic feet sold as our correspondent did originally. Meantime, readers of the above communication will bear in mind the points of the editorial notes to the letters that were published on July 16, 23, and 30, and Aug. 13, and judge accordingly.—ED. J.G.L.]

Gas Companies and the Price of Coal.

When sending a report of the proceedings at his Company's recent half-yearly meeting, the Chairman of a Provincial Gas and Water Company wrote: "May I draw your attention to my remarks on the coal question, as affecting gas companies, consumers of gas, and the public generally, as coal users. I do not know how far the space at disposal in the "JOURNAL" may allow of these remarks being noticed by you; but in any case I hope you will agree with me that some effort should be made by gas companies throughout the country to protest energetically against the heavy increase in coal prices caused by recent legislation, and more especially by the withdrawal of the export coal-tax. An opportunity to do this occurs at the time of the half-yearly meetings; and as coal has recently gone up in price to an alarming extent—both for ordinary uses and gas manufacture—the Chairman's remarks at these meetings are likely to find popular support. I need hardly say that I am quite indifferent as to my personality being prominently or otherwise brought out in the matter; but I do not wish my remarks to be taken as having a political meaning."

Improvements at the Burton Gas-Works.

At the meeting of the Burton-on-Trent Town Council last Wednesday, the Gas and Electricity Committee recommended the acceptance of the tender of Messrs. John Walsh and Sons, of Halifax, to put into working condition the nine settings in No. 5 retort-house; and they also suggested having two retort-house governors fixed on top of the retort-bench by Messrs. W. J. Jenkins and Co., Limited, of Retford, and four Dillamore tar-columns erected by the same firm. The Mayor (Alderman Lowe) explained that the retort-house was built in 1898; the contract for the benches being let to the firm who submitted the lowest tender. The retorts had not lasted so well as was expected, having only been used for about a year altogether. Now it was necessary to take out some of the work. The other improvements recommended would make the gas more equal in illuminating power, and its manufacture cheaper. The recommendations were adopted. Referring to this matter, the writer of "Local Topics" in the "Burton Daily Mail" last Thursday said: "The reforming hand of Mr. Bell is seen in the expenditure of over £830 on one of the retort-houses, the erection of new tar-columns, and other minor improvements at the gas-works. That Mr. Bell has completely gained the confidence of the Council since he took over the post of consulting expert was shown by the fact that the expenditure, after the Mayor's concise and able explanation, was agreed to without a dissentient voice yesterday. I, for one, consider that Mr. Bell is giving a new lease of life to the gas undertaking."

LEGAL INTELLIGENCE.

DAMAGE TO ROADS BY EXTRAORDINARY TRAFFIC.

Some weeks ago the Reigate Rural District Council took proceedings in the Redhill County Court against the Sutton District Water Company, to recover £238, the cost of repairing roads alleged to have been damaged by the defendants through the use of heavy traction-engines in the construction of a reservoir. At the conclusion of the plaintiffs' evidence, Judge Scully held that there was no case, as it did not appear that the damage done was in consequence of any orders given by the defendants, who had no control over the haulage. From this decision the plaintiffs appealed; and the matter came before Justices Darling and Lawrence, who ordered a new trial. The case was heard by Deputy-Judge Humphreys, whose judgment was read by Judge Scully at a recent sitting of the County Court. His Honour said that for the purpose of the construction of the reservoir it was necessary that a large quantity of ballast and other materials should be taken to the site, principally in trucks drawn by traction-engines; and some 4000 tons of ballast and other materials were conveyed in this way between May 4, 1905, and Feb. 6, 1906. Considerable damage was done to the roads by the engines and trucks continually passing and repassing over them; and on May 28, 1906, the Surveyor to the plaintiffs gave his Council a certificate showing that extraordinary expenses to the extent of £238 4s. had been incurred by them in repairing roads. The defence to the action was threefold. First, that the action was out of date, inasmuch as the proceedings were not commenced within twelve months of the time at which the damage was done, or not within six months after the completion of the contract or work, in accordance with the provisions of section 12, sub-section 1 (*b*) of the Locomotives Act, 1898. It was admitted that the work was a building contract, or work extending over a long period within the meaning of the sub-section; but it was contended that the work which actually caused the damage to the roads was completed on Feb. 6, 1906, and that this was the date from which the six months' limit was to be calculated. If this contention was correct, it would naturally follow that the defendants, if liable at all, would only be liable for any damage done to the roads since Nov. 1, 1905; and it was admitted that by far the greater part of the damage was done before this date. Secondly, it was contended that the damage done to the roads, and the excessive weight and extraordinary traffic passing along and upon them, was not caused by, or in consequence of, any order of theirs; and, thirdly, it was said that the amount claimed was excessive. In his judgment, the first and second contentions were not well founded. With regard to the first, the view he took of the sub-section was that the six months limited by the Act was six months from the time of the substantial completion of the contract or work the carrying out of which had caused the damage to the roads, and not from any particular incident of the work. This being his view, he found that the actual work to be done was not completed until the middle of May, 1906; and therefore the action was brought in time. With regard to the second contention, he found that the carrying of the ballast and other materials by traction-engines and trucks was a natural and usual way of conveying such large quantities of materials; and he held that this method was resorted to in consequence of the order given by the defendants to their Contractor to build the reservoir. They were therefore liable for the expenses incurred by the plaintiffs in repairing the roads in question, but only for those directly attributable to the damage done by the excessive weight and the extraordinary traffic on the roads caused by the traction-engines and trucks. He assessed these expenses at £163 13s., and he gave judgment for the plaintiffs for this amount, with costs. Execution was stayed in view of an appeal.

ELECTRIC LIGHT CHARGES OBJECTED TO BY THE GAS COMPANY IN MELBOURNE.

The Judicial Committee of the Privy Council (consisting of the Lord Chancellor, Lord Macnaghten, Lord Atkinson, Lord Collins, and Sir Arthur Wilson) recently heard the arguments in an appeal from a judgment of the High Court of Australia, reversing a decision of the Supreme Court of Victoria in an action by the Attorney-General of the State of Victoria, on the relation of the Metropolitan Gas Company, against the Corporation of the city, to restrain them from continuing to charge for electricity rates which were not uniform per unit. The matter has already been noticed in the "JOURNAL," and the facts were not in dispute. It was admitted that the Corporation supplied electricity under two different systems at rates appropriate to each, but not identical. Under the first, the quantity used was charged for at the rate of 4½d. per unit—the flat-rate. Under the second, a rate of 7d. per unit, known as the "maximum demand rate," was charged for such portion of the electricity supplied as was equal to a consumption, for a period of 45 hours per calendar month, at the highest rate of consumption during that month, and a rate of 2d. per unit for the remainder. Both rates were less than the maximum rate authorized by an Order made under the authority of the Electric Light and Power Act, 1896. It was admitted that it was optional with every customer, or intending customer, to choose the system under which he should be supplied; and that, as between the several customers under each system, no preference was given to one customer over the other, though under the operation of the second system different results worked out in the case of different customers, as must be the case where, as in this instance, the consumption was taken into consideration in fixing the price. It was contended on behalf of the plaintiff that the defendants' mode of carrying on their business was illegal; and that they could not have two different systems of supply, and were only entitled to charge one uniform rate for all electricity sold by them, irrespective of the quantity, or the time when, or the circumstances under which, it was supplied. The Supreme Court, considering that the case came within the principle of a previous decision in an action between the same parties, by which the defendants had been restrained from supplying electricity for heating or power purposes at a rate lower than that charged for lighting purposes, granted the injunction. On appeal to the High Court of Australia, the decision was reversed, and an order was made dismissing plaintiff's action with costs. From this decision the present appeal had, by special leave, been brought.

Mr. Danckwerts, K.C., and Mr. E. Morten appeared for the appellant; Sir Robert Finlay, K.C., and Mr. A. C. Nicoll represented the respondents.

The result of the decision of the Supreme Court was the passing of an Act in 1901, by the Legislature of Victoria, making it unlawful for any undertaker within the meaning of the Act of 1896 to charge for the supply of electricity used for power or heating purposes respectively, or both, a lower uniform rate than that charged for the supply of electricity employed for lighting purposes. In the appeal, it was contended, on behalf of the plaintiff, that terms of the statute of 1901 amounted to a declaration that, according to the true meaning of the Act of 1896, only one uniform rate could be charged by the defendants for the electricity supplied by them throughout their district. Section 13 provided that conditions and restrictions might be inserted in, or prescribed by, the Order in Council made under the Act with regard (*inter alia*) to "the limitation of the prices to be charged in respect of the supply of electricity." Section 38 was practically identical with the 19th section of the Electric Lighting Act, 1882; but section 39, dealing with preference, differed in its wording from section 20 of the Act, relating to the same subject. It had been held by Lord Justice Buckley that the words "a supply on the same terms," used in section 19 of the English Act, bore their natural meaning and included price. Mr. Danckwerts contended, however, that the same words, contained in the corresponding section (38) of the Victoria Act could not, by reason of the provisions of section 39, be held to include price. Lord Atkinson (who delivered the judgment) said that their Lordships could not concur in this view. They thought the "preference" prohibited in substance by it was a "preference" between customers dealing under similar circumstances, and not between customers dealing under two different systems of supply, either of which they were free to select, and therefore dealing under entirely different circumstances. This construction reconciled the two sections 38 and 39 one to the other, and made them consistent, did no violence to any of the provisions of either, did not impose on the defendants, as would the construction contended for on behalf of the plaintiff, most embarrassing restrictions in the conduct of their undertaking, and at the same time promoted rather than interfered with the interests of the consumers. Their Lordships were therefore of opinion that the decision of the High Court was right and should be affirmed, and the appeal dismissed, with costs.

Disputed Meter Registration.

At the Llandudno Police Court, on Monday last week, Mr. A. Conolly, the Clerk and Solicitor to the Urban District Council, sought to recover from Mr. W. T. Parker £5 16s., the balance of a claim for about £7 odd for gas supplied. It appeared that defendant used the gas for heating a hot-water urn and for a gas-stove; and the amount sued for was for the gas consumed in the Christmas quarter last year. On receiving the bill, Mr. Parker complained that it was excessive, and the meter was removed and tested. Three tests were made—two by the Meter Inspector and one by the Gas Manager (Mr. Walter Shadbolt). By the first test the meter was shown to be 3·9 per cent. fast; by the second, 2·56 per cent. fast; and by the last (the Gas Manager's test), 3·73 per cent. fast. On the basis of the last test, the Council offered to allow a rebate of 7s. 6d.; but Mr. Parker refused to accept it. Mr. J. E. Hallmark, for the defendant, said that since Mr. Parker took over the business in 1905 the average amount of the gas bill had not exceeded £3 per quarter; and he was naturally astonished when he received the demand for upwards of £7 for the Christmas quarter. For the month in this year which elapsed before the meter was changed, the gas cost £2 5s. 8d.; while for the two months of the Lady Day quarter which followed the change of meter, the cost was only £1 7s. 4d. It was obvious that the meter was seriously out of order, and that therefore the reading ought not to be accepted as evidence of the consumption. The Bench, however, made the order for the amount claimed, less the deduction of 7s. 6d.

Gas-Works for Santa Cruz.—It is stated in the "Engineer" that a concession has been granted by the Municipality of Santa Cruz to a merchant of Bremen to erect gas-works. The concession extends over a period of 75 years, and also gives the sole right of laying gas-pipes in the streets and of supplying private houses with gas for lighting and cooking purposes.

Gas-Works Profits at Stalybridge.—The Stalybridge Elective Auditors (Messrs. Gill and Tonge) have lately made their report on the finances of the Corporation. The profit realized on the gas undertaking was £2863; and the Auditors remark that this is "the most satisfactory item in the borough fund account." They add, however, that "it is more than absorbed by the precept required to be paid for the luxury and convenience of an electric car and lighting scheme."

Winding-Up the Pontefract Gas Company.—The Pontefract Gas-Works having been acquired by the Town Council, the Corporation have paid the amount of the purchase-money (£69,600), the half-year's interest to June 30 (£1292), the amount then due to the bankers (£1340), the costs of winding-up the Company, the bankers' commission, and the taxed costs of the arbitration. The Liquidator (Mr. Claude Leatham) has paid to the shareholders £20 in respect of each 10 per cent. £10 share, and £14 in respect of each 7 per cent. £10 share, and has informed the shareholders that there now remains in his hands £14,353, from which they might expect to receive approximately a further sum of £5 5s. 6d. per share on the 10 per cent., and £3 13s. 10d. on the 7 per cent. shares; making totals of £25 5s. 6d. and £17 13s. 10d. respectively for each £10 share. Resolutions for the winding-up of the undertaking on this basis have been passed; and the Company will be finally wound-up on the 1st prox., or as soon after as possible.

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Wednesday, at the Cannon Street Hotel, E.C.—Sir GEORGE LIVESEY in the chair.

The SECRETARY (Mr. Frank Bush) having read the notice convening the meeting, and the minutes of the last ordinary meeting, the seal of the Company was affixed to the register of proprietors, and the report and accounts for the six months ending June 30, which have already been given in the "JOURNAL," were taken as read.

A GOOD GATHERING—THE REPORT.

The CHAIRMAN: Ladies and gentlemen, I think the Board may take it as a high compliment to see such a gathering in August at our general meeting. It is very gratifying to us to see so many shareholders present. I have to move—"That the report and accounts now presented be received and adopted, and the report entered on the minutes." Well, there is a great deal of interest to us in the report; but whether it is so to the shareholders may be another matter. I am afraid this will be rather a lengthy meeting; and I hope I shall not exhaust your patience. In the first paragraph of the report, we give as much information as possible, feeling that the Company is the property of the shareholders, who have a right to know as much about it as the Directors are able to inform them within the limits of the report.

THE INCREASE IN THE PRICE OF GAS.

There are several important matters dealt with here; and the first, and one of the most serious—perhaps the most serious—is the increase in the price of gas. I dare say it will be asked why we have increased the price, while some other companies have not done so. Well, ladies and gentlemen, there are two policies in most things. Our policy has been to reduce the price always when we found it possible to do so. Whenever we have found ourselves with a surplus sufficient to warrant the reduction of price, we have reduced the price; and the consequence is that we have never accumulated a surplus to any extent. Therefore when adverse circumstances have arrived, such as a great increase in the cost of coal, we have no surplus profits to fall back upon, and an increase of price is inevitable. The other policy is to accumulate a considerable surplus of undivided profits carried forward from half-year to half-year, and then, when times like these arise, to use up these balances instead of increasing the price. It is just a question as to which is the better course. I think it must be more satisfactory to the consumers to feel that the gas is always supplied to them as cheaply as possible. I think another reason for the policy we adopt is that consumers, employees, and shareholders are all partners, whether in prosperity or adversity; and as they share in the advantages of prosperity, they ought to bear the brunt of adversity—all being in the same boat.

LARGE UNDIVIDED BALANCES.

For this reason I think the Board are justified in adhering to the policy that has been pursued from time immemorial, of not accumulating a large undivided balance, but letting the consumers have the advantage of a reduction as soon as we are able; and when times like these arise, explaining the matter fully to them, and the reason why we have increased the price. The circular we sent to the consumers explaining the reasons for the increase of price was a sort of invitation to them to comment on our action; but so far—and it is more than a month since the circular was distributed—no complaint has been made. In fact, those who have written have generally said: "We are satisfied with your reasons for the increase." But it may be said, "Surely there is an advantage in having a certain amount of money in reserve." Well, though we have never tried to get a large balance in the profit and loss account to carry forward, we have, by self-denial, out of dividends built up a very respectable reserve fund, which now amounts nominally to £181,000. It is not, however, quite equal to that, because stocks have depreciated. The fund has remained untouched for many years, and is likely to remain untouched, for it will only be used to meet some unexpected and unavoidable loss, and not an increased cost of coal. We can wait until there is a turn in the value of securities. Then we have another fund—the insurance fund, in order to meet any extraordinary accident for which we could not make provision. This amounts to £108,000. So that we have nearly £300,000 of reserves, though we have only £505 as a balance to carry forward. Now, in our report we explain the position; we point out how it is that the three interested parties are partners in profits and losses. If adverse circumstances arise, we increase the price of gas. This takes something from the consumers. It also takes a considerable sum from the shareholders, and it takes about £10,000 a year from the employees. Now, when all the interested parties feel that they share as nearly as possible fairly—for one cannot compare the shareholder with the consumer exactly, or the employee, but when they feel that they share fairly in gains and losses—all three parties are likely to be content. We reduced the price three years ago (at Midsummer, 1904); and from that time the shareholders were entitled to £5 14s. 8d. per cent. dividend. We have not earned it in these three years, and we have not paid it. We have only paid the 5½ per cent. which we had been paying to the shareholders—they having foregone the 4s. 8d. per cent., or £15,700 a year. The increase of price will reduce the dividend payable from £5 14s 8d. to £5 6s. 8d. But seeing that the shareholders have only had 5½ per cent., the actual reduction to them will be 3s. 4d. per cent. instead of 8s.; and instead of being £25,700 a year, the reduction will only be about £10,000. I think the shareholders may well have contended that, while the consumers and employees have had their full benefit, the shareholders did not get theirs; but it is a proud satisfaction to us to feel that the shareholders never have complained. It is often remarked about shareholders that they have one sordid object, and one only, in view; and that is to get the highest possible dividend regardless of all other considerations. But it is a very happy thing for us to be able to say here at these meetings that the shareholders of this Company have never shown anything of the sordid spirit whatever; they have always been ready to look at matters in a liberal and fair spirit. I do feel this, however, that when we are able to reduce the price again the time has come when the shareholders should have their full benefit whatever it may be. At any rate, when we reduce the price 1d., which I hope we shall do before very long—I hope it will not be much more than a year, at any rate—then the 5½ per cent. will be restored. Now, it seems to us that this system of ours—a partnership of shareholders, employees, and customers—is ideal.

GAS NO LONGER A MONOPOLY.

At one time gas companies had an absolute monopoly of the supply of artificial light; but we have not that now, though we have a monopoly of the supply of gas. There is a great amount of public feeling against monopolies, and a good deal of that is reflected on gas companies. The public say: "You are a monopoly; you do just as you like; you charge what you please." Well, competition is the alternative to a monopoly. Now, competition in the supply of gas is an impossibility. Parliament settled that forty years ago; and it is impossible to re-open it. The practical difficulties are sufficient to bar that. Then where are we? There is no competition; there is a monopoly. How are the public to be protected? By making it to the interest of the shareholders and employees to do the best they can for the public; and then you get benefit equivalent to competition. Competition is life; without competition there would be stagnation. What is wanted is that we should have a sufficient motive to do our best; and the application of the sliding-scale ensures that for the supply of gas to the public. It makes it to our interest to do all we can to serve the public well; and I think in the future we must see that the shareholders get their full rights. Well, then, the employees are in the same boat. It is to their interest also to serve the shareholders and the consumers well. If we can reduce the price, both dividend and bonus go up. Now that, as we say in the report, is an ideal system.

THE COAL MARKET AND THE COAL-TAX.

I come now to the second paragraph, and ask you to compare ours with the coal trade. In the coal trade there are two parties interested—the coal owners and the coal miners. But where are the consumers, the users of coal? The coal owners, and the coal miners too, pressed the Government very hard a year or two ago for a repeal of the duty on exported coal, which they said came out of their pockets. They do not say so now; and I will just state the facts with regard to the coal that was exported. When it paid a duty, sometimes the coal merchant or the coal owner undertook to supply the coal for a foreign port. There is a phrase in use, "c.i.f." (coals, insurance, freight), which is an inclusive phrase. The shipper said: "We will deliver coal, say, in Bordeaux c.i.f. at a certain inclusive price." When the tax was on, it came to be c.i.f.t. (coals, insurance, freight, tax); and when the coal owners undertook to deliver coal abroad, they put the 1s. tax—they have told me so themselves—on the price of coals to be sold abroad. When I was speaking about it to the Chairman of a foreign Gas Company (who is a large buyer of coal), he said he bought the coal free on board; but before he could take the coal out of the country, before the ship could be cleared, he had to pay the tax for the coal going to France. So, in abolishing the duty, I can not see that any benefit whatever has been conferred on the British nation. It has increased the cost of coal no doubt; it has increased the foreign demand; but I never could understand why Mr. Asquith took off the duty. A little light was thrown upon it the other day. I have cut this out of the "Daily Chronicle," dated July 31. There was a debate on the Finance Bill, and the Chancellor of the Exchequer was called to account for not having reduced taxation. In his defence he said that "when people said the Government had done nothing to reduce taxation, he would remind them that last year he remitted the coal-tax." He reduced taxation to the foreigner; but I do not see how thereby he reduced taxation to the Britisher. "He would remind them that last year he remitted the coal-tax at a cost of £2,000,000; and this year the tax would have produced something like £2,500,000." Then he says he has taken 1d. off tea and some other things; but to put in the remission of the coal duty as reduction of taxation is an enigma to me. I have been very much found fault with for what I have said about this matter. A reporter came to see me one day, and I said something to the effect that, instead of taking the duty off, it would have been better to have increased it to 2s. per ton, and so have got £4,000,000 instead of £2,000,000. Some of the papers took this up, and said what nonsense it was for me to talk like that, and to say that the duty would by this time have produced £4,000,000 when the increase was only £500,000. What I said was that the duty should have been raised to 2s.; and I must say, speaking broadly and generally, it seems to me a suicidal thing for England to deplete itself of its coal, its capital. When coal is gone, England is done for; and as coal gets higher in price, so it makes it harder for everybody in England to live.

MINERS' EIGHT HOURS BILL.

The Government are now contemplating introducing an Eight Hours Bill to compulsorily reduce the hours of labour in mines to eight hours a day from bank to bank—that is, about six-and-a-half hours' work. Now if these coal miners were a down-trodden set of men who could not help themselves—helpless and hopeless, one might say—Parliament might do something for them. But they are not. There is no more powerful body in the kingdom than the coal miners, I suppose, as a body of working men; but there is just one thing that saves the public—there is a division among them. The Federation of Miners, controlling practically all England, Scotland, and Wales (except Durham and Northumberland), want the Eight Hours Bill. But the Durham and Northumberland miners do not want it; and if this Bill is passed, there will be no division between these two strong, powerful bodies of miners. I do not say the coal owners wish to combine with the miners; but there is no doubt they will be forced to, in their own interests, if this Eight Hours Bill is passed. It will tend very much to produce a union between coal miners and coal owners; and the interests of the country will be left out in the cold. I wish to draw special attention to this second paragraph: "Parliament also introduces Eight Hour Bills,

which, if passed, will increase the cost of getting coal, while the interest of the consumer of coal, which means every individual in the country, is ignored and forgotten. In this matter the interest of the consumer of coal, be he a manufacturer or a railway, water, gas, or electrical company, or the domestic user, is paramount. If the users of coal—that is, everybody, forgetting that everybody's business is nobody's business—do not press their claims on Parliament in opposition to the efforts of interested parties and faddists, the position is in great danger of going by default." Well, we make our protest; and if people allow Parliament to do it, the people must suffer.

LARGE INCREASE OF CONSUMERS.

I have nothing to say about the accounts. They are satisfactory. Last half year there was a deficiency of £9000 odd. I told you we should make it up in the June half year, which is always better than the December half; and on the whole the accounts are more satisfactory than we expected. There has been a large increase in the number of consumers. Slot-meter consumers have increased. They were 198,080 in June of last year, and now they number 212,945—an increase of nearly 14,000. But of these slot-meter consumers, 3791 were ordinary meter consumers, who have changed to the slots. Otherwise it would appear that our ordinary business is not progressing. Last year we had 102,169 ordinary meters; and this year the number is only 100,767—that is, 1400 less; but 3800 have changed from one to the other. It means a gain of 2400 ordinary consumers and about 10,200 slot-meter consumers. Well, this shows that the business is going on; and I think we are now beginning to see, if not the end, to see our way out of the loss of consumption resulting from the change from ordinary burners to incandescent mantles. We are now beginning to get a little increase again; but for several years we have had practically little or no increase. The increase is not much, it is true. Still, it is nearly 2½ per cent.; and I think we may look forward to a return to something like our normal increases when the incandescent mantle has done its work.

THE RATING APPEAL.

I have only a word or two to say about rating, because really it is not a thing that affects the shareholders to any serious extent. We have tried to get a fair system, and to get rating put on a fair basis, but so far have failed. The system is as unsatisfactory as anything could be. We say here: "The system of rating gas companies could not be more unsatisfactory, confusing to the last degree, understood by no one, and perhaps least of all by the Courts of Quarter Sessions who hear the appeals." I think gas companies would do well to take action themselves—it might be started in London in the first instance—to promote a Bill in Parliament for the rating of gas companies on a fair, clear, and understandable principle. Of course, such a Bill might not be passed; but, at all events, it would open the subject and show the necessity of something being done. But as to the shareholders it is a matter of perfect indifference. The rating we pay is over £80,000 a year. I think that is about half as much again as it ought to be fairly. Supposing then that there is £26,000 or £27,000 excess in the rating, that would amount to about ½d. per 1000 cubic feet. If we could save this £26,000, the price of gas might be reduced ½d. per 1000 feet were it practicable to reduce by halfpennies, and the consumers would save £26,000 a year. What would the shareholders get? They would get about 1s. 4d. per cent. additional dividend, that is all. So that supposing we are paying £26,000 a year too much in rates, if that were saved it would only affect the dividend to the extent of 1s. 4d. per cent. per annum. But we never divide such small amounts. It comes to this, that the burden is borne by the consumers, who are also ratepayers. We have done our best in this rating matter to protect the consumers, and to prevent gas being unduly charged for. I am sorry to say that the two necessaries of life—water, which is the most important of all, and gas, which is also very important—pay very much more in rates than any other article of consumption, simply, I believe, because the system of rating is so unfair. But it does not matter to the shareholders. I now come to the last paragraph of the report, which is a very satisfactory one. We say: "If the Company's position is, to an extent, war without, it is peace within. The consumers are well disposed towards the Company, and the employees of all ranks are loyal and interested in its welfare. Of course, in both, there are here and there exceptions. But, speaking generally, the relations are very satisfactory." It is a great satisfaction to the Directors—and to the officers and workmen, too, because they hear more of it—to find that the consumers regard us as men who wish to deal fairly and considerately, and can feel that they are safe in our hands. Then as to the employees of all ranks, they are loyal and interested in the welfare of the Company; and as to any difficulties, I think that is an impossibility. The other day I came across a presidential address by Professor Merivale to the North of England Institute of Mechanical Engineers. After speaking of the Conciliation Boards and the sliding-scale, he spoke of the further stage which is to be reached when the identity of the interests of capital and labour will be recognized by everybody, as it now is by the few, and disputes between capital and labour will be impossible. Well we are among the few who have recognized the identity of the interests of capital and labour. The shareholders of this Company have behaved very nobly in the matter, and have always, when this question has come up, shown sympathy with the workman and the labourer, and have supported the Board in all their proposals for the promotion of "a righteous peace in the industrial world," as it is described by President Roosevelt. We are to-day bringing before you a proposal for the alteration of our Workmen Directors scheme; and I will therefore defer any further remarks on the subject until we come to the special meeting. I will conclude this rather drawn-out speech by proposing the motion which I have read.

Mr. ROBERT MORTON seconded the resolution.

Dr. DRYSDALE asked whether the amount of gas produced per ton was stationary, or whether it had increased?

The CHAIRMAN: It has rather gone back, because we have had to buy different coal. It has gone back about 100 cubic feet per ton; the figure being now 10,838 feet, instead of 10,956 feet.

A SHAREHOLDER asked as to the monazite sand suspense account being some £10,000 less.

The CHAIRMAN: We have paid that off and got rid of it.

A SHAREHOLDER asked how and where the £181,000 of the reserve fund was invested.

Sir FORTESCUE FLANNERY was sure he would be expressing the general feeling of the shareholders in offering the congratulations of the Company generally to the Directors upon the position they had put before the meeting. There was, of course, the drawback of the increased price of gas; but if the Board desired any expression from the shareholders side of the table upon the alternative policies of charging a high price for gas when coal was not so dear, and so accumulating a large fund, and making only small profits from the gas and leaving it to consumers and employees and the gas workers to share adversity with the shareholders' when the pinch should come, he had no hesitation in saying that the general feeling of the shareholders was to support the policy of the Board. One of the great arguments against the co-partnership idea—joining the workers with the shareholders—had been that the workers would hesitate to share adversity, although they would very gladly share prosperity. But the experience of this Company had proved the contrary. He considered it an excellent training both for shareholders and their co-partners to feel that, when adversity, if in a mild form, should come, they were partners in that as well as in prosperity; and that very fact would, he believed, tend largely to keep them together and maintain the excellent system which had been established. It was matter for congratulation that something near 5 per cent. had been added to the number of consumers. The great foundation for the prosperity of the Company was in having a large number of consumers; and, personally, he wonld rather see a large number of small consumers than a small number of large ones taking the same amount of gas. The Chairman had kept back the heaviest shot in the locker for the special meeting; and with regard to the co-partnership scheme, he thought it matter of great congratulation that they should have reached this special milestone upon the road to civilization. The peculiarity of previous schemes was that they would expire automatically by the effluxion of time; but the scheme to which the shareholders would, he was sure, presently give unanimous support would automatically continue until it should be found wanting. On behalf of the shareholders, he wished to express satisfaction with the report, thank the Chairman for his clear and lucid speech, and express the intentions of the shareholders to give him their support, they hoped for many years to come, in the good work he was doing.

The CHAIRMAN, in reply to the question as to the investment of the reserve fund, said the whole of the money was not invested; a certain proportion being held for working capital. But over £100,000 was invested in first-class securities—debentures, preferences, corporation stocks, and so on. These securities did not, however, stand to-day at the value they cost; having depreciated by about £11,000. Taking this £11,000 from the £181,000, the nominal amount of the reserve fund, they had £170,000 available in hard money.

The resolution was carried unanimously.

The DEPUTY-CHAIRMAN (Mr. Simpson Rostron) moved: "That a dividend at the rate of five and one-half per cent. per annum be now declared, and that the warrants be transmitted to the registered addresses of the proprietors by post." It was a great advantage that they had two audits in all Metropolitan gas accounts, as used to be the case with the Water Companies before they were all absorbed. The accounts underwent not only the supervision of their own Auditor but of a Government Auditor appointed by the Board of Trade, whose duty it was to see that all amounts properly chargeable to revenue were noted before the amount of profit out of which the dividends were payable was ascertained. The double audit provided for the security of their dividend. The shareholders might be interested to know that, according to a table drawn up by the Secretary, 5⅓ per cent. was the exact average of the last 21 dividends, beginning in June, 1897, and including the present one; and that was the dividend which, under the operation of the sliding-scale, the shareholders would receive next March. The table began with 5¼ per cent., and then went up to 5⅓ per cent. Then, in 1900-01, for two half years the Board were obliged to reduce the dividend more than on the present occasion; and it then fell to 5 per cent. For the last three-and-a-half years, they had enjoyed 5½ per cent. The cause of the reduction in 1900 was the same as now—namely, a boom in coal, which had been very largely influenced by the expansion of the export trade following the remission of the 1s. per ton duty. As the Chairman had told them, this was a very serious matter not only for this Company but for all gas companies, and also other industrial undertakings. In order to give them some idea, he had taken out the figures of the Board of Trade returns from the "Economist" of Saturday last; and shareholders would be astonished at their dimensions. For July there was a total increase of revenue from raw material amounting to £1,196,000, of which no less than 94 per cent., or £1,131,000, was from the coal exported; the total quantity being 6,098,000 tons. The amount for the whole seven months of the year was 35,747,000 tons, of the estimated value of £21,758,000. Well, these were gigantic figures; and how far it was wise to allow such enormously increasing drafts on what might be called the mineral capital of the country, without any regulation or supervision such as a small duty would impose, it was not for him to decide. But it was a very serious question, and well worth the attention of every man. These figures would give an idea of the enormous loss of revenue which had followed the remission of the coal-duty. The people who got the benefit of the expansion of the export trade were the coal owners and the miners. The question then arose: How long will it last? That was impossible for anybody to say; but he hoped it would only be for a short time. He ventured to hope also that some good result would come out of it, as resulted from the coal famine of 1873, when Mr. Forster's Committee adopted the sliding-scale which had brought about the prosperity of the great gas companies.

Mr. CHARLES T. DRUMGOLD seconded the resolution, which was carried unanimously.

Extraordinary Meeting.

The CHAIRMAN: Now, ladies and gentlemen, I will proceed with this further matter. In the last paragraph of the report it is said: "The partnership in management by the Employee Directors, after nine years' experience, has answered the most sanguine expectations. The first scheme was for three years and the second for nine years; but the Directors now think it desirable to make the system permanent." This was what we said in the report; but since the report was printed,

an overlooked paragraph in the Act of Parliament authorizing the election of Employee Directors rather prohibits permanency. It says: "On the cesser of such scheme, and subject to the provisions of this Act, and to the like submission, adoption, and approval, a new scheme may at any time be adopted for any period that may be in that scheme prescribed and so from time to time." Therefore we propose in our scheme to settle it subject to certain conditions up to 1950. This is far enough to look ahead; if it is not a success by that time, it never will be. I hope a good many others will have followed our example by that time. This is so far as the correction of the report is concerned. I will now proceed to tell you about this scheme. When we promote a Bill in Parliament we do not send a copy of the proposed Bill to every shareholder, but the heads of it are read at the meeting; and I now propose to read the heads of this scheme. The first page of it gives an extract from the Act of Parliament authorizing it. By that we are bound as to it being for a period, and some other matters, the qualification and the fees, and one thing and another; and then we go on: "And whereas in 1898 the total investments of the employees in the ordinary stock of the Company amounted to £55,000 nominal, and a scheme for the election of three Employee Directors for a period of three years was adopted; but only two workmen were elected, the salaried officials not exercising their option." This is merely historical. Then in the next paragraph: "And whereas in 1901 the total investments of the employees in the ordinary stock of the Company amounted to £89,000 nominal, and a similar scheme for nine years was adopted, with power to determine it by the shareholders in 1904 and 1907, and one clerk and two workmen Directors were elected; and the working having proved in every way satisfactory, it was in 1907 considered desirable to supersede the scheme of 1901 by one for a very much longer period." The remark about this is: Why do we want to supersede the scheme that is now running from 1901 to 1910? We have been going on with this for nine years altogether. The first scheme was for three years, and the second for nine years, of which six have expired; and to tell you the truth one reason is a little bit personal. I should like to see this thing settled definitely, and my colleagues are all of the same mind. "And whereas the total investments of the employees in the ordinary stock of the Company now exceed the nominal amount of £200,000." The £200,000 nominal is over £240,000 actual market value. We were allowed to have Employee Directors when their investments amounted to £40,000. We did not appoint them until the investments amounted to £55,000 nominal. When the scheme was first renewed, they were £89,000; and now they are over £200,000. Now I come to the clauses of the scheme. "This scheme, which repeals and supersedes the scheme of 1901, shall come into operation as soon as it has been adopted by the shareholders of the Company in manner provided by the South Metropolitan Gas Act, 1896, and approved by the Board of Trade, and shall continue in force until 1950, or short of that year, so long as the shareholders approve (see section 14), and the aggregate investment of the employees in the stock of the Company shall not fall below the nominal amount or amounts set forth in section 4." We think it would not be a wise thing to fix the Company absolutely to this system. Although we have every confidence that it is right, still it is not a wise thing to bind or tie ourselves absolutely to anything that is new. Then we come to section 4, which deals with the aggregate holding of stock. The nominal amount of paid-up ordinary stock of the Company is £6,430,000, and the employees own over £200,000 or thereabouts, or a 1-32nd part—the other shareholders holding 31-32nds. The holders of the vastly greater proportion of the stock elect seven Directors; and under this scheme power is given to elect three Employee Directors. Well, this is a very much larger proportion; but we first adopted the scheme when they had only £40,000 stock, to enable the employees as soon as possible to share in the responsibility of the management, as they were sharing in the profits. We are trying to better distribute wealth among employees. With the distribution of wealth there must be a sharing of responsibility, or there is no proper sharing at all; and so we introduced a Workman Director scheme as soon as possible, in order to educate the workman in the responsibility of managing a commercial business. Then we say: "The essence of the co-partnership is that the employees' holding of stock shall increase year by year by the investment of their co-partnership bonus." It has increased year by year to £200,000; and every year it increases largely. Supposing the employees should lose confidence in the Company, and, instead of investing their money in the Company, should sell out that which they hold. That is going back; and if they cease to invest their property in the Company they will cease to have the right of representation. So we make this provision, that "If at any time the aggregate investment of the employees should fall back by 10 per cent. of its amount below any figure it may have attained less than one-tenth part of the paid-up capital, the number of Employee Directors shall be reduced to two by lot. If the reduction should amount to 20 per cent., the number of Employee Directors shall be reduced to one by lot." If they come down from £250,000 to £200,000, then they lose two Employee Directors. Then we say: "A reduction of 30 per cent. shall disqualify the remaining Employee Director, and then only as provided in section 14 can the Employee Directors be restored." We have considered this fully with the Employee Directors; and I am glad to say that they think this a fair and reasonable thing. So long as the employees continue to increase their investments in the Company, so long do we say that they are entitled to, and should share in, the responsibility of management; and when they cease to have confidence in the Company, and reduce their holding, then they have no right to have anything to do with the responsibility of management. So that it is an automatic sort of arrangement. But we do not think it will happen that the employee will lose confidence in the concern. Then we make this further proviso, that: "So long as the aggregate holding exceeds one-tenth part of the ordinary nominal capital, the above provisions as to reductions shall not apply." As the amount of the capital is £6,430,000, when the employees hold £643,000 and upwards, we say they have more than one-tenth of the capital, and are entitled to have Employee Directors anyhow. It is only when the holding falls below this that these provisions will apply. As to the qualification of an Employee Director, the Act says he must have a holding of not less than £100, and have been in the service not less than seven years. We say now: "Having been continuously not less than fourteen years in, and continuing in, the employ of the Company"; and the having held for not less than twelve months prior to the date of election, and the continuing to hold, not less than £120 in the stock of the Company. We have raised the qualification from £100 to £120; and we have provided for a further increase. When the aggregate holding is £200,000, the qualification is to be £120 of stock; and the fee £1 2s. 6d. per attendance When the aggregate holding is £300,000, the qualification is to rise to £140; when it is £400,000, the qualification is to be £160; when it is £500,000, £180; and when it is one-tenth of the capital of the Company, £200 is to be the qualification. The fees are to rise in proportion until they amount to the maximum allowed by the Act, which is not exceeding what an employee would have earned at his regular work in four days. The nomination of candidates, and the voting, not by ballot, are all details which need not occupy our time. One Employee Director is to retire every year, and is eligible for re-election. Those elected in 1898 are still on the Board—the workmen have re-elected their men every year, year by year. They say: "We are satisfied with the men we have got; we have got very good men, and we stick to them." Then there is power to the shareholders to terminate the scheme. "This scheme shall continue in force, subject to the limitations in section 2 [that is, to 1950] so long as, in the opinion of the shareholders, it answers its purpose of promoting a true union of employers and employed." If it does not fulfil that purpose it is a failure; and the sooner it is got rid of the better. Therefore this provision is inserted in the scheme giving the shareholders power to terminate it if it should fail to answer the purpose of promoting the true union of employers and employed. The procedure will be this: it is not to be a hasty action. At the February meeting in any year, if the Directors are satisfied that the thing is not answering its purpose, they can give notice that at the next meeting they will propose a motion for the abolition of the scheme; and if the shareholders at the August meeting approve, the scheme will come to an end within a year. The details may be varied from time to time. This is an important matter. It is committing you to a definite action on this great question of allowing employees to take a share in the management of the business in which they work. In the case of this Company and in that of the South Suburban Company (who have had a similar scheme for three years and have now renewed it till 1950), the workmen have certainly selected, I think I may say, the best men they could have found qualified at the time to represent them. These gentlemen have sat on the Board with us now for nine years, and have in every way acted fairly, reasonably, and sensibly. They have not taken any light view of their duties. They have looked at the interests of the Company as a whole—shareholders, consumers, and employees have all been considered; and the Directors are in every way satisfied with the experiment so far as it has gone. One of our colleagues, Mr. John Ewart, is, unfortunately, absent. He was opposed to the scheme nine years ago; but he seconded its renewal six years back, and he regrets that he cannot be here to-day, for if he had been he would have seconded it on this occasion. You are doing something more then for this Company. You are taking a step for the securing President Roosevelt's "righteous peace in the industrial world." If that righteous peace can be established there is no doubt whatever that the British nation will be in a far better position than it now occupies. What is really wanted by this great industrial nation is to bring the two wings of the industrial army into line, working together. At present they are very much like the sport known as Tug of War—both pulling in opposite directions and trying to pull each other over. This is what is being done in Belfast. That is what has come of the Trades Disputes Bill for peaceful picketing, which was the beginning of the trouble. I do not say that every man is loyal and devoted; some of them we know are rather taken in by the Socialist talk which is so common. They are told they do not have their proper share of what they produce. I read in a local South London paper the other day that of every 1s. 6d. the workmen produces he only gets 4½d., and nonsense of that sort, which working men sometimes believe. There are some of them, I know, who are rather taken with these Socialistic notions; but they are a very small minority, and it would be utterly impossible for them to do us any harm whatever. We have got very far beyond that; and now we ask you to put the final seal to the work, and instead of this Employee Director system being a temporary matter, subject to lapsing after a short period of three years or nine years, or whatever it may be, to make it a fixture, subject to the above-named conditions, until the year 1950. I move: "That the scheme now submitted to this meeting for the election of Employee Directors, made under the provisions of the South Metropolitan Gas Act, 1896, and the South Metropolitan Gas Act, 1897, be approved and adopted, subject to such alterations as the Board of Trade may suggest, and the Directors agree to."

The DEPUTY-CHAIRMAN, in seconding the motion, said that, in the presence of his Workmen-Director colleagues, he would not be so impertinent as to praise them; but at the same time he might tell the shareholders that they had a breadth of view and a grasp of any question that came up for consideration at the Board. The shareholders' interests were as well looked after by the Employee Directors as by the Chairman or any other member of the Board. In his experience, the scheme had worked very well. It had promoted good feeling, not only among the Directors but among the workmen generally. It was part and parcel of the bonus partnership system; and with regard to that, they would perhaps like to have one or two figures which Mr. Bush had turned up. During the last 16 years, the average payment on the bonus system was £19,000. Sometimes, of course, it was much more; sometimes it had been very much less. It looked a huge sum; but he would point out that during that period the sales of gas had increased by 1333 feet per ton of coal carbonized, and the carbonizing wages had also much decreased. He would only mention one other thing, and that was that they might on suitable occasion do good to the Company, and to the interests of capital and labour, by recommending this scheme. He had on several occasions recounted his experience of it; and he found that people were very much interested in it, and considered the scheme very much better than they thought it was.

Rev. CANON CROMWELL, as one who did not belong to the laity, but as a clergyman who had devoted many years of his life to the study of

co-partnership, desired to support the scheme. He thought the plan was the surest and safest way to the permanent prosperity of the Company. He was glad that masters and workmen could now see eye to eye; and that being so, the Company need not fear foreign competition. They had been told that the real cause of a smaller dividend being paid was owing chiefly to the high price of coal and the heavy increase in rates; and as they were all householders, and therefore interested in these two questions, he wished to point out that it was Parliament who had increased the price of coal, and borough councils who had increased the rates. Then arose the question whether each one in his own sphere could do anything to improve this state of things? His answer was "Yes, study the character of the men you send to Parliament, and of those you place on the councils." He was aware that a large portion of the British population took pride in not mingling in politics; but he thought this was a mistake. His advice was "Look to Parliament and to your Councils."

Mr. GEORGE HOWLETT thought the scheme was a liberal one and well worthy of support. He did not believe there were many in this country who would listen for any time to Socialistic notions. Socialism was no new thing. On one occasion, when in Leeds, he heard two men who were on their way to a meeting discussing the subject. One asked the other how much per man there would be when all the wealth of the country was shared out, and, being told that it would be about £124, said: "Then I am going home; I shall have nothing to do with it, as I have £136 at the bank now." He believed that was the feeling that was running through all the employees of this Company.

The resolution was passed unanimously.

Dr. DRYSDALE proposed a hearty vote of thanks to the Chairman and Directors for their able management of the Company's affairs.

Mrs. ALICE VICKERY seconded the motion, which was carried unanimously.

The CHAIRMAN: I think this is the first time the vote has been seconded by a lady; and the Board appreciate it all the more on that account. I have simply to thank you for your kind vote; it is not a formal thing, and for that reason we value it all the more. I now beg to propose a hearty vote of thanks to the officers. Mr. Carpenter, the head of the engineering department, I think will tell you that he has been very ably supported by the men under him; and we have the greatest satisfaction in feeling that Mr. Carpenter is our Engineer. Then we have Mr. Bush, the head of the clerical and collection department, of whom I can speak quite as highly as of Mr. Carpenter. I am sorry to say that Mr. Bush has had a serious illness; but I am thankful that he has now recovered. We do not want anything to happen to him. The difficulty is to get him to take sufficient holiday. However, we are glad to have him among us to-day.

Mr. H. T. AUSTIN said he had great pleasure in seconding the motion. Having to work under Mr. Carpenter, he could bear testimony to his merit, and to the fact that the Company had efficient engineers at the various stations. The men co-operated well with the engineers, and rendered as far as they could faithful service for the benefit of the Company.

The resolution passed unanimously.

Mr. CHARLES CARPENTER, in returning thanks, said in every department, from the highest to the lowest, he had always been ably supported. He might refer to a point which had been raised by one speaker, from which it might be inferred they had reached high-water mark in the make of gas. It was not that their plant was less efficient, or not so well looked after, but the class of coal handled had been different. During the half year they had carbonized between 50 and 60 per cent. of Yorkshire coal instead of Durham; but the difference in the make of gas per ton of coal carbonized, compared with the high-water mark, was only 1 per cent. He thought this fact spoke volumes for the carbonizing staff.

Mr. FRANK BUSH desired to thank them most heartily for the vote of thanks which had been passed to the staff, and also for the kind remarks made about himself. He hoped that in the course of a week or two he should be fully restored to health; for, if he could help it, he did not intend to be a valetudinarian. Allusion had been made to the fact that the employees were partners in adversity as well as in prosperity, and that by the increase in the price of gas the bonus would be reduced. But there was another aspect to the question. The employees had upwards of £200,000 of stock, which was bought for them by trustees; and it might interest the shareholders to know the price paid for the stock during the last five years. In 1902, the price paid was 123; in 1903, 121½; in 1904, 123; in 1905, 131; and in 1906, 131. He again thanked them for the hearty vote of thanks which had been accorded to the staff.

COMMERCIAL GAS COMPANY.

The Ordinary Half-Yearly Meeting of the Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. W. G. BRADSHAW in the chair.

The SECRETARY (Mr. H. D. Ellis) read the notice convening the meeting.

In signing the register of stockholders, the CHAIRMAN observed that some 300 more stockholders would be shortly joining the Company. These would be employees who had become entitled to £5 worth of stock, by reason of the profit-sharing scheme. It was very gratifying to know they were becoming proprietors.

THE PRICES OF COAL AND OIL AND OF GAS.

The Directors' report and accounts having been taken as read,

The CHAIRMAN said it was his privilege to move their adoption. The accounts the Directors were submitting that day bore upon them some indication of the large rise in the price of coal and of oil which had taken place, although only rather less than one-third of the coal used during the half year had been purchased at the higher price. Since the Directors met the proprietors in February last, the new contracts for the year ending April 30 next had been made; and, as he foreshadowed in February, they were at a considerably augmented price. The rise in the price of coal was due in some part to the somewhat abnormal activity in the industries of the country, and in part to the removal of the export duty which had certainly fostered the demand from abroad, if it did not create it. The price of oil had, as usual in some measure, followed the price of coal; but the increase had been much aggravated by the heavier charges for freight from America. Fortunately, during the last twenty years, they had become accustomed to the fluctuations in the price of raw materials; and for some time past, they had been making preparations to meet it by building up their undivided profit from half year to half year. He was glad to think, they had a substantial sum, which was available to keep down the price of gas, and to maintain the dividend. As to the future, no apprehension whatever need be felt as to the position of the Company. The demand for new supplies continued to be brisk; business was very good; and the increase in its volume was satisfactory. But at the same time, the Directors deplored having had to raise the price of gas. For the present, they thought 1d. per 1000 cubic feet increase in the price—from 2s. 5d. to 2s. 6d.—was sufficient; and they meant to strain every nerve to avoid a further increase. If success attended their endeavours, he did not think any of the co-partners in the scheme would really feel the advance. The consumers' bills would only increase by a very small amount; their profit-sharers would suffer the loss of some £530, which represented ½ per cent. on their bonuses; while the proprietors would be still entitled to the same dividend, because for some time past they had voluntarily foregone a small portion of the dividend which, under the Acts of Parliament, they might have paid. But he was bound to say that 1d. per 1000 cubic feet in the price of gas only represented £12,800 per annum; and it was altogether insufficient to meet the heavier charge for coal and oil. To make up the additional cost, they would have to look to the increase in their business, to better prices for residuals, and to greater economy and efficiency in their working. What these failed to produce, they would have to take from the undivided profit carried forward. If all these sources failed them, or proved to be insufficient, or if the higher price of coal was long maintained, then he feared there would be no alternative but to again raise the price of gas; but the Directors would never forget that it was in the interests of all parties to keep the price of gas as low as possible.

HOW OTHER COMPANIES HAD FARED.

The proprietors (or those of them who did not already know) might be interested to hear how the other Metropolitan Gas Companies had fared. The South Metropolitan Company had had to advance their price by 3d. per 1000 cubic feet—from 2s. to 2s. 3d. The Gaslight and Coke Company had met the situation by re-imposing meter-rents, which they relinquished some years ago; and as they had a very large sum of undivided profit, they hoped to get through the twelvemonth without increasing the price of gas. All who were interested in the gas industry were pleased to see the prosperity of the premier Company; and he was sure they heartily congratulated the Directors and executive officers generally on the position and prospects of the concern, which must be attributed in no small degree to the energy and wisdom of their management.

THE BOARD'S POLICY.

While on the subject of coal, he should like to say that the Board had purchased only the best Durham coals, because their experience had taught them in the past, when they had sometimes bought small parcels of inferior coals, that they were more expensive in the long run, though they could at the moment be bought at a lower price. Their policy had also been based on the consideration that the Yorkshire ports might become congested, and that the Company would suffer loss through the detention of their steamers; and they had felt that perhaps just when the demand for gas was the heaviest, they might not be able to obtain the supply they needed. He thought the policy of the Board was correct, because he read in the daily papers that, even in the height of the summer, when the demand was the lowest, steamers had been kept waiting outside the ports unable to enter to load their cargoes.

"COALITE!"

The half year with which they were dealing had seen the long-expected advent of the Company which was going to mitigate London fogs by introducing a new smokeless fuel, which had been called "Coalite." He supposed they were all agreed that any invention that would do something to lessen the volume of black smoke which now defiled the atmosphere of London was to be heartily welcomed. But the Gas Companies had been making considerable progress in this direction for many years past by introducing gas-fires for cooking and heating. The users of gas-fires at the present time were getting their cooking and heating done at a small increase in price compared with the heavy charges now being made for household coals. With regard to "Coalite," there was very little difference between this material and what gas companies called coke. Coke was manufactured by carbonizing coal in clay retorts for six hours at a temperature of 1800° Fahr.; and from the coal was taken some 10,000 to 11,000 cubic feet of gas per ton of an illuminating power of 14 candles. Coalite, on the other hand, was produced by carbonizing coal in iron boxes for eight hours at a temperature of 800° Fahr., extracting from the coal only some 5000 or 6000 cubic feet of gas per ton, of an illuminating power of something like 20 candles. They had purchased some "Coalite," and had experimented with it. He must say that it gave a bright, attractive looking fire without any appreciable smoke; but from what he had seen, and from what he had heard, he gathered that "Coalite" burned away very quickly, and, therefore, was likely to be rather an expensive fuel. All he could say was that if "Coalite" should prove to be a success, and there should be a great demand for it, then gas companies could produce something almost precisely similar, and they ought, therefore, to share in whatever profit there was in it. The proprietors need be under no misapprehension that the Company would suffer much from the competition of "Coalite." The Gaslight and Coke Company had produced, with their ordinary apparatus, a very similar substance which they called "Carbo;" and they were prepared to put it on the market at any time.

THE HALF-YEAR'S WORKING.

Turning from what may be to what is, the Chairman directed attention to the principal items in the accounts. Referring first to the capital

account, he said that during the half year they had sold by auction £50,000 of their 4 per cent. stock, which produced £51,747. The effect was not apparent, except to a small extent, in the accounts, because the larger part of the stock was only paid for on July 2, after the accounts were closed. The account showed they had received £11,669; and so there was a balance of £40,078 paid up after June 30. Then with regard to the capital account, the proprietors would he thought observe, with satisfaction, that there was again no charge for works or mains, but only for the provision of stoves and prepayment meters, and services to supply them. Their Engineer advised them that their works were amply sufficient for any increase in trade they were likely to get for some time to come, so that he (the Chairman) hoped they would avoid increasing their capital account in respect of works and mains. The figures showed a reduction of the Company's capital expenditure per million cubic feet of gas. It was gradually coming down; and they were pleased to see it doing so. Turning to the revenue account, they had sold 1578 million cubic feet of gas in the half year, against 1530 millions in the corresponding period of 1906—an increase of 48 million cubic feet, representing 3·14 per cent. upon their sales. The Gaslight and Coke Company had an increase of just over 3 per cent., and the South Metropolitan Company one of 2½ per cent. The advance in the sales gave them an increase in the revenue from gas of £5552; the comparative figures being £187,246 for the past half year, and £181,693 for the corresponding half of last year. From stove and meter rental, they received an additional £2166; and from residual products, £5874—the total increase of revenue, allowing for £9 less in miscellaneous receipts, being £13,583. The gross cost for manufacture and distribution £14,089 more; so that the net profit was less by £506. The balance to the profit and loss account was £61,806, against £62,311. Here he should like to mention that, while the extra quantity of gas manufactured was 3 per cent., the total carbonizing wages had only increased by less than 1 per cent.; and as further evidence of good working in the retort-houses, he might say that the make of gas per ton of coal carbonized had increased from 10,745 to 11,036 cubic feet. He thought this testified to the good work of the employees, the foremen, and the engineers. Dealing with the gross profit of £61,806, it was sufficient, after deducting the interest on the debenture stock and floating balances, to pay the dividend they had been accustomed to receive now for some ten half years—that was, £5 4s. per cent. on the 4 per cent. stock, and £5 per cent. on the 3½ per cent. stock, and leave a surplus of £556, which the Directors proposed to carry forward to the current half year, making the balance of undivided profit £23,503. For some time past now they had been adding to their reserve fund at the rate of rather over £1000 a year, and they had been adding to the insurance fund at a nearly similar rate. The reserves of the Company—including the reserve fund proper, the insurance fund, and the sum carried forward—now amounted to more than £90,000; and this compared very favourably indeed with the reserves of the two other Metropolitan Companies, which, considering the size of the concerns, were not so large. As to the future, he had no misgivings; though he did not expect that, when the Board met the proprietors in February, they would have earned their full statutory dividend. But he did hope that, if the increase in their sales kept up, and if the price of residuals improved, they would be justified in recommending to the proprietors the payment of the same dividend as they proposed that day.

The Deputy Chairman (Mr. Walter Hunter) seconded the motion.

Mr. George Ennis, referring to the Chairman's allusion to the coal situation, remarked that he believed the congestion at the ports was prevalent to a considerable extent now. The coal was going abroad in large quantities; and it seemed to him that this was one of the political chickens of the present Government coming home to roost. He thought this might have been arrested by maintaining a duty of 1s. to 2s. per ton of coal, and keeping some of the coal at home. He hoped, when the facts as to the situation reached the ordinary consumer, it would bring about a revulsion of feeling, and a better state of things than the present. He hoped the advance in the price of gas would be found adequate.

The motion was unanimously carried.

Proposed by the Chairman, and seconded by the Deputy-Chairman, a dividend was declared at the rate of £5 4s. per cent. per annum upon the 4 per cent. stock and of £5 per cent. per annum upon the 3½ per cent. stock, both less income-tax.

Prepayment Meter Robberies.

On the motion of Mr. Arthur Harston, seconded by Mr. Wilshaw, and supported by Mr. Charles M'Naught, a hearty vote of thanks was passed to the Chairman and Directors. The last-named gentleman said that many of the proprietors noticed what seemed to be the increasing appearance of their Solicitor in the Police Courts, prosecuting thieves of cash from prepayment meters. What he wanted to elicit from the Chairman was whether there was an increasing propensity in the locality in which the Company operated to rob these meters, and whether the total sum at stake was so large as would appear from the frequency of the prosecutions.

The Chairman, having acknowledged the vote on behalf of himself and his colleagues, said, as to the question of robberies from slot-meters, the ratio did not increase, because the number of slot-meters had grown so largely. The number had gone up from 50,000 to nearly 59,000 in the last twelve months. The Board were only discussing that morning whether there was any possibility of avoiding these robberies. It was, of course, a very difficult question. The prepayment meters were very flimsy things; and if a man wanted to break one open, he could easily do so. He did not know what, without going to great expense, the Company could do in this matter. Considering the number of meters fixed in the Company's district, the amount lost from them was really infinitesimal. But from the point of view of morality, they would be very glad if they could find means to prevent the robberies. He was bound, however, to confess that he did not know what the means should be. Proceeding, he proposed a vote of thanks to the chief officers, their staffs, and the employees—remarking that the work of the half year had been well and efficiently done. Their relationship with the workmen was of the best possible description. The other day the Board had a meeting with the Profit-Sharing Committee (one-half of whom were elected by the workmen, while the other half were the nominees of the Directors), and it was one of the pleasantest meetings they had ever had. There was proof of good feeling on all hands; and the members of the Committee entered most cordially into the position of the Company, and with no grumbling that the bonus was falling by ½ per cent. The reduction of the bonns would cause the men to suffer perhaps more heavily than either of the other co-partners. It was a great grief to the Directors that they were obliged to curtail the bonus; and they would look forward with the greatest pleasure to the time when it would get back to its past best figure. The staff and workmen had now an interest in the Company amounting to nearly £35,000; and he (the Chairman) was happy to say that of this sum £29,000 was wholly due to the profit-sharing system. He did not think this had cost the proprietors anything in the way of dividend; he did not think it had added anything to the price of gas; but he did know that it had added materially to the prospects and well-being of their workmen.

The Deputy-Chairman, in seconding, joined in all the Chairman had said regarding the merits of the profit-sharing system. When the Directors visited the works the other day, they were pleased to see the state they were in; and the Profit-Sharing Committee were gratified because the Directors noticed this.

The motion was unanimously carried.

Mr. Ellis responded on behalf of himself and his staff; recognizing most fully his own indebtedness to the staff for their assistance. Referring to the position of things in the Money Market, he said everybody was aware how much first-class securities had depreciated. Consols had depreciated more than anything else; on the previous Monday the price was as low as 80¾—probably a record price, even after making allowance for the difference in the rate of interest. It must be gratifying to gas shareholders to observe that, while Consols had gone down, gas stocks had kept fairly steady. There was one other point to which he might be permitted to refer. He thought it must be confusing to some people that a dividend of £5 4s. per cent. should be declared on a 4 per cent. stock and £5 per cent. on a 3½ per cent. stock. Of course, all present at the meeting understood the matter, but the man in the street did not. He put the point respectfully to the Board whether it would not be more convenient if it were resolved to call the 4 per cent. stock, "A" stock; and the 3½ per cent. stock "B" stock.

Mr. Stanley H. Jones (the Engineer) also responded on behalf of himself, his staff, and the workmen. In his concluding remarks, he alluded to the robberies from prepayment meters, and said that the proprietors need not have any fear that the Company did not take every possible step to stop these. It was generally found that a fresh crop of robberies was due to a band of hooligans, who were run to earth eventually. The peculiar character of the East-end district would always bring this kind of thing into view; but they could not hope to avoid it entirely.

SHEFFIELD UNITED GASLIGHT COMPANY.

Half-Yearly Report and Accounts.

In the report to be presented by the Directors at the half-yearly general meeting of the Sheffield Gas Company on the 3rd prox., they make the satisfactory statement that the combination of good trade in the city, gloomy and cold weather, and last, but not least, the very low price of gas, resulted in an increased sale, in the six months ending the 30th of June, of 133,811,000 cubic feet, or 9·33 per cent. more than in the corresponding period of last year. The charges per 1000 cubic feet of gas were: From January to March, 1s. 5d., 1s. 3d., and 1s. 1d., according to consumption; and from April to June, 1s. 4d., 1s. 2d., and 1s.—the average price over the half year having been 1s. 3·49d. The accounts accompanying the report show that the sale of gas produced £100,203, and of residuals £67,941; the total revenue being £177,952. The expenditure on manufacture of gas amounted to £96,092 (coal costing £54,405 and repairs and maintenance of works and plant £21,539); on distribution to £14,921, and on management to £6073; rents, rates, and taxes came to £9302; and the total expenses were £127,869. The balance of £50,083 is carried to the net revenue account. The Directors recommend the payment of the usual dividends on the three classes of stock, after which there will be a sum of £2440 to be added to the balance carried forward from previous half years.

WANDSWORTH AND PUTNEY GAS AND COKE COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the Company's Offices, Fairfield Street, Wandsworth—Mr. H. E. Jones in the chair.

The Secretary (Mr. Chas. W. Braine) read the notice convening the meeting; and the Directors' report and the accounts were taken as read.

The Company's Half-Year's Progress.

The Chairman said it was again his pleasing duty to move the adoption of the report and accounts. The material question for the proprietors was that the profits for the past six months enabled the Directors to recommend the declaration of dividends at the statutory rates; and in addition they had the rather satisfactory surplus (satisfactory because they were not a Company that indulged in surpluses as a general rule) of £2492. The working throughout the undertaking had been very good. The income had increased by £4200, made up of £2570 for gas, £543 for meter and stove rental, and nearly £1200 for residual products. The amount of gas sold was 507 million cubic feet, which showed the gratifying increase of 5¾ per cent. There was an increase in the number of consumers of 446, which was a trifle less than their usual addition. The increase was chiefly among the automatic meter consumers, who accounted for 305 of the total. An additional 557 stoves had been sent out in the half year, which could only be attributed to

the higher price of coal driving people to use the cheapest gas in London for cooking. The amount of capital spent in the half year was very small—£1734. It consisted of £348 on mains and services; and the whole of the rest was for the supply of meters, stoves, and automatic fittings. With reference to the expenditure, if comparison were made with the June half of 1906, the costs would be found singularly alike. The whole cost of manufacture was within a few hundred pounds the same; and distribution was a few hundreds less. The item of rates and taxes was £200 more; and, with this exception, all of what he might call the humdrum charges were about the same. Inasmuch as the income was, as he had shown the proprietors, larger for gas and residuals, they had the satisfactory profit of £15,939, which was £2900 more than the profit for the corresponding period of last year.

COAL AND GAS PRICES.

The Directors had realized with some concern that they had had to make their new contracts for coal at a very heavy advance; but they had not given notice of any increase in the price of gas at present, because they felt it was desirable to see what the exact working of the half year was before coming to any conclusion. Seeing that they had the very satisfactory surplus of £2492, that some of their coals at the lower prices would continue to be supplied during the current half year, and that the oil contract had been renewed at a fairly moderate advance, the Board thought they were justified, in this district—where the authorities had always met the Company very reasonably and fairly—in refraining from raising the price at present. The rating had been fairly adjusted; and the removal of lime purification had been volunteered by their kind friends, the local administration, before the Company got their Act of Parliament last year, and rendered it legally operative. Therefore the Board thought it only right to follow their old principle of postponing as long as they reasonably could the incidence of the extra coal prices upon the consumers. But he could assure the proprietors that they had not the slightest intention of frittering away the balance or reserve fund by the Quixotic process of supplying gas at less than it cost them, and so encouraging the gentlemen dealing in the coal trade to suppose they could avail themselves of the balances always in the hands of gas companies. In the early part of this year, he cut a slip from the "JOURNAL OF GAS LIGHTING" [Feb. 19, p. 492] quoting a statement from the "Sheffield Daily Telegraph" (a paper which was in touch with the coal-mining interests). This Sheffield paper said: "An arrangement has been entered into between the colliery owners in Yorkshire, Lancashire, Derbyshire, and Notts, with a view to so lifting contract prices for gas coal that a portion of the large profits now being earned by gas companies in all parts of the country shall be transferred to the colliery owners' pockets." Now there were people who said that the advance in the price of coal was not a matter that was under the influence of the coal owners at all, but that it was merely a question of the markets; but those who read the "JOURNAL OF GAS LIGHTING" would find the words he had quoted put on record in its columns, showing clearly what the intention was, before the ordinary period when gas undertakings were making their contracts. Undoubtedly, there was a considerable increase of trade in the country, involving the use of a larger quantity of coals; and gas companies would not complain of that in the least if that were the only cause for the increased coal prices, because this would mean there was more money circulating in the country, and consequently more gas, residuals, and so forth would be consumed. But unfortunately the export duty of 1s. per ton was let go about a year ago; and this happened to coincide with some bad accidents in coal mines on the Continent, and with certain activity in other markets in the northern part of Europe. Therefore, gas companies found they were not merely competing with the coal users of England, but were confronted with the stimulated competition from these foreign sources by the concession in the way of the coal duty, which would compensate buyers probably for nearly half the cost of shipping coals from our shores to those of other countries. This had been pointed out with the greatest emphasis by the *doyen* of the gas industry, Sir George Livesey. The reply made by a member of the House of Commons was: "Yes, but see how this country is enriched by the sovereigns that flow in from the coals that flow out." That was about as short-sighted a view of the political economy of the position as could possibly be, because a ton of coal in the mine was practically so much more money in the bank; and for this country it meant not only the money value realized if it were sold abroad, but industrial value if it were used to turn mills or engines or to promote the manufactures of England by the employment of British labourers, who unfortunately at the present time were complaining of want of employment, However, it was not for them to indulge in politics in connection with the Company. What they had to do was to run their own happy course in the best way they could. But for himself and for his colleagues, he might say they regretted the short-sighted removal of the 1s. per ton. As a Director of three or four foreign gas companies, he might say that, on the face, it formerly did appear that the abolition of the duty would give them some slight relief; but the result was that, instead of giving them relief, it had stimulated competition from the Continent in our coal market, and so raised the price of coals by a very much larger amount than the shilling made in countervailing advantage.

UNSATISFACTORY STATE OF THE RATING QUESTION.

The past year had seen the settlement of the quinquennial reassessments. Re-valuations came in the years ending with "5" and "0," and their discussion took place in the years ending with "6" and "1." In their own case, they were able to settle the assessments peacefully and he thought not unrighteously. He was the more pleased over this because rating questions had been very much in the air; and two or three efforts that had been made by gas companies to get better justice in these matters had not been so far successful. He should weary the proprietors if he told them what a difficult and troublesome subject this was. They were assessed from the view of a hypothesis which could be dragged and strained in every direction according to the interests of the gentlemen engaged in applying the hypothesis. The one gleam of satisfaction he had, in reading his papers, was that the Premier had said there was in view a Rating Bill, which, if it followed the report of the Royal Commission on the subject, would probably sweep away the present troublesome, vexatious, costly, and entirely unsatisfactory process by leaving the establishing of rating value of an undertaking like their own in the hands of perfectly impartial and qualified men. At present, as the proprietors were aware, municipal government was carried on by means of the rates; and it was so very easy to raise the rates from gas, water, and other companies. Very often, in his own practice, he had found a surveyor employed for the purpose of making reassessments paid by commission on all he could stick on. Extra money was required for such things as they had seen exposed to public criticism by certain inquiries in different parts of London, the sense of proportion of the authorities in which seemed to be of a character which led them to spend as much on one pauper as would relieve three, under the mistaken notion that they were wisely and philanthropically discharging their duty. He could not conceive a more spurious form of philanthropy than that of wasting the money that was extracted from different industrial companies which gave employment to so many. He had travelled beyond the direct limits of the resolution, which it was his pleasure to move; but he felt very acutely the importance of the matters upon which he had spoken.

The DEPUTY-CHAIRMAN (Mr. T. A. Ives Howell) seconded the motion, which was unanimously adopted.

The CHAIRMAN next moved the declaration of dividends at the rates per annum of 8 per cent. on the "A" consolidated stock, of 6½ per cent. on the "B" consolidated stock, and of £5 12s. per cent. on the "C" stock. He wished to point out that the only part of the £438,000 which constituted their capital that received the 8 per cent. was £30,000, and that the whole of the capital that they were now, and had recently been, calling up had to be contented with the modest dividend of £5 12s. per cent. The moderateness of these dividends should really be borne in mind by those people who assessed the Company for rating, because the most extraordinary delusion was abroad based on the fact that, in theory, gas companies were allowed to pay 10 per cent., and that they supplied very little to the consumer beyond the meter, and therefore had little of what one might call tenant's interest in the rating question as now established. In their case they only received £5 12s. per cent. on their capital; and that would probably be much less for future investors, who would have to buy by auction at a price that would only yield 4½ per cent. The hypothesis in rating was that one interest should have 5 per cent. and the other 17½ per cent. The proprietors could form their own arithmetical calculations as to the possibility of getting any portion of 17½ per cent. with the 5 per cent. for themselves when money was raised in the market at 4½ per cent.

The DEPUTY-CHAIRMAN seconded the motion, which was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. H. S. FREEMAN, a resolution was proposed increasing the salary of the Secretary by £100 per annum. In the course of his remarks in submitting the resolution, the Chairman made handsome recognition of the services of both the Secretary (Mr. Braine) and the Engineer (Mr. H. O. Carr); and these gentlemen subsequently made their acknowledgments.

Moved by Mr. J. C. BADCOCK, C.B., seconded by Mr. J. DENNY, a hearty vote of thanks was passed to the Chairman and Directors.

A WARNING TO GAS STOCKHOLDERS.

The CHAIRMAN responded. In doing so, he said he should like to warn proprietors against parting with their shares at too low a price. Their Company had worked up a strong position. The dividends were moderate; but they were very certain and sure. There was, in fact, no more stable property in the gas industry than the stock of the Wandsworth Gas Company. He was sorry to see there had lately been, through some unexplained circumstance, sales of stock at less than it was worth. It was possible the advance in the price of coal might have caused some little revulsion of feeling. He did not say the advance in the price of coal would not cause some disposition to reduce gas stocks in the public estimation. He did caution proprietors in this Company that theirs was a property quite of the first class, and ought not to be sold at a lower rate than the best gas property in the country. That, at all events, was his own opinion.

BROMLEY GAS CONSUMERS' COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Tuesday, at the "Bell" Hotel, Bromley—Mr. ALEXANDER DICKSON in the chair.

The SECRETARY (Mr. H. W. Amos) read the notice calling the meeting; and it having been agreed to take as read the Directors' report and the accounts,

The CHAIRMAN moved their adoption. In doing so, he said the salient feature in their business in the half year had been, he thought the proprietors would all agree, the continued increase in the sale of gas. The increase was 6¾ million cubic feet, which was about the same as that of the corresponding half of last year, when it was 7 million cubic feet. It would be remembered that, in their last report, the Directors notified to the proprietors a substantial advance in the price then ruling for gas coal. There had since been a further considerable advance; the present price of Durham gas coal being quoted at fully 60 per cent. above its cost only two years ago, and about 100 per cent., or double what it was sold for a few years back. The lower price for coal had enabled the Directors to reduce the price of gas to the lowest rate ever reached by the Company; and they had been indulging the hope that the economies they were effecting by the new manufacturing plant, might enable them to still further reduce the price. These hopes, however, had been frustrated for the present, and without the slightest possibility of their having been able to prevent it. The untimely withdrawal of the export duty on coal, concurrently with its larger use in home industries and factories, presented an opportunity to the coalowners and the miners of which they had promptly availed themselves. He thought that no one begrudged the increased cost of commodities arising from activity in the home industries. But whatever might be their individual appreciation of the ethics of a national system of export and import duties, or of the unrealizable ideal of absolute free trade, the fact to-day in the

gas industry was that both shareholders and consumers of gas in the vast multiplicity of trade and household interests dependent upon its use, were being seriously prejudiced by the abnormal inflation of the price of gas coal, which had been so greatly facilitated by the concession to foreign buyers and by their purchases in the British coal markets. The Company's two contracts for the twelve months, each from a new field of supply, had been made at prices exceeding 50 per cent. over those of two years ago; and, in the circumstances, the advance in the price of gas, to 3s 3d. per 1000 cubic feet, was unavoidable. While the Board would most gladly hail an early return to normal prices, one could not, unfortunately, in the face of recent reports, discern at present any rift in the cloud. That they did endeavour to supply gas as cheaply as possible, was attested in this: That, whereas the reduction to 2s. 11d. per 1000 cubic feet was 1s. 7d. below the statutory price, and thereby authorized a dividend on the "A" stock at the rate of £7 7s. 6d. per annum, the holders of that stock had only been taking 6 per cent. per annum, and in the case of the "B" stock, the holders had been receiving £4 10s., instead of £5 17s. 6d. The foregoing of this difference had, *pro tanto*, allowed a cheaper price to be charged. So with gas at 3s. 3d. per 1000 cubic feet, the dividend authorized on the "A" stock was 6⅞ per cent., and on the "B" stock 5⅜ per cent. per annum, or ⅞ per cent. per annum on both stocks above the current dividend. The surrender of this difference would similarly enable the charge for gas to be so much lower than it would otherwise have to be. He took it the stockholders generally would be, as they had been, content it should be so until at least better times came round. Half-yearly dividends of 3 per cent. on one and 2¼ per cent. on the other of the Company's stocks, could not be classed as other than reasonably moderate. He was glad to be able to confirm the report the Directors made at the last meeting upon the economies derived from the recently erected coke-conveyor and coke-haulage plant. It would, however, perhaps be more satisfactory to reserve the actual figures until they had a complete year's working before them. At the next meeting he should be in a position to give the figures to the proprietors, if they would be interested in having them. Turning to the accounts, the proprietors would have noticed, in making comparisons, that the increased revenue from gas, meter rental, and coke approximated to £2000 in the half year, and that this advantage was practically absorbed by the extra cost of coal and other increased charges in the expenditure. There were, quite regularly, small variations in the amounts of most of the subsidiary service accounts, which, however, about counterbalanced one another in the total. To these he need not refer, beyond saying that the carbonizing wages were less by £235—not that the Directors had reduced the payments to any of those they retained in their employ, but naturally a lessened number of hands were required to work the new plant. The net result of the half year was that the balance carried to profit and loss account, after deducting interest on debenture stock and loans, sufficed for the payment of the same dividends as heretofore on the ordinary capital stock, and yielded a surplus of £109 to be added to the balance of undivided profit to be carried forward, which would then be £2296. In addition, the reserve and contingency funds would stand at about £9000.

The DEPUTY-CHAIRMAN (Mr. Bertram H. Latter) seconded the motion, which, after a few observations from proprietors on matters of a purely domestic nature, was unanimously carried.

Proposed by the CHAIRMAN, and seconded by Mr. HUGH WYATT, a dividend was declared at the rates per annum of 6 per cent. upon the "A" ordinary stock and 4½ per cent. on the "B" ordinary stock, less income-tax.

The Chairman and Directors were heartily thanked for their services on behalf of the Company, on the motion of Mr. G. WEEKS, seconded by Mr. F. W. PEILL.

The CHAIRMAN, having replied, moved a similar complimentary vote to the Engineer (Mr. W. Woodward), and to the Secretary (Mr. H. W. Amos), both of whom, he said, had had to take their full share of the anxieties and responsibilities that recently beset the Company's way.

The motion was cordially agreed to.

Mr. WOODWARD in thanking the proprietors for their kind expression of good will and appreciation of his services, remarked that all gas engineers had a rough time at present, what with labour troubles, the new Workmen's Compensation Act, and dearer coal. Although they had to face a higher price for coal, with the better results they were getting by the aid of the new machinery, and one thing and another, they would be able to tide over these difficulties.

PROVINCIAL GAS COMPANIES.

Gas and Electricity Supply at Ascot.

In pursuance of the provisions of the Ascot District Gas and Electricity Act, 1906, under which the Ascot Company are now working, only one general meeting of shareholders has to be convened—viz., in the month of February. The Directors are, however, empowered to declare an interim dividend; and they have accordingly issued the accounts for the six months ending the 30th of June. They show that the revenue in that period was £5475, compared with £5216 in the first half of 1906; while the expenditure was £3358, compared with £3199. The balance carried to the net revenue account is £2117, against £2017 this time last year. The amount available for distribution is £2581; and an interim dividend at the rate of 5½ per cent. per annum (less income-tax) is declared. The quantity of gas sold for private consumption in the half year was 19,485,600 cubic feet, and an estimated quantity of 423,000 cubic feet under public lighting contracts; making a total of 19,908,600 cubic feet. The electricity works are now in process of construction, and the Directors state that they already have indications of a satisfactory demand when the supply is available.

Increased Sales at Camborne.

A satisfactory report was presented at the annual meeting of the Camborne Gas Company last Wednesday. The statement of Mr. W. Bailey, the Secretary and Manager, showed that the make of gas had increased by 1½ million cubic feet, and the sales by upwards of 1 million cubic feet. The output of residuals had also shown a satisfactory increase. It was pointed out that though the price of coal had advanced by 12½ per cent., there was no increase in the price of gas. It was decided to pay a dividend of 3 per cent. for the half year, making 5½ per cent. for the year. Mr. H. P. Vivian presided over the meeting; and it was reported that the Directors had elected him Chairman, in place of Mr. J. M. Holman, who had resigned his seat on the Board.

Increased Sale of Gas at Melton Mowbray.

At the annual meeting of the Melton Mowbray Gas Company held last Friday, under the presidency of Mr. T. Glover, J.P., the Directors expressed their pleasure at reporting an augmented sale of gas, a much larger revenue account, and greater profit. Prepayment meters realized £2250—an improvement on the year of £370; and it was thought there was every probability that the business would increase. General satisfaction was expressed; and though coals are costing much more on the new contract than on the old one, the Directors were in a position to say that they did not think the price of gas will have to be increased. The usual dividend of 7½ per cent. was declared on the whole of the capital.

Another Successful Year at Taunton.

The report presented at the annual meeting of the Taunton Gas Company last Tuesday showed that in the period covered by it—viz., the twelve months ended the 30th of June—the quantity of gas sent out had been 98,374,500 cubic feet; being an increase of 4,110,700 cubic feet over the quantity delivered during the preceding twelve months. The accounts showed that the revenue amounted to £19,184, and the expenditure to £13,849; leaving a balance of £5335 to be carried to the net revenue account. The amount of profit available for distribution was £8385, out of which the Directors recommended dividends at the rate of 5 per cent. on the preference stock, 8 per cent. on the consolidated "A" stock, 7 per cent. on the "yellow" shares, and a similar amount on £12,900 of new ordinary stock. These dividends would absorb £3720. The Directors further recommended that the additional dividends (of 1 per cent. and ⅞ per cent. respectively) which are payable under the sliding-scale, and amount to £454 2s. 6d., should be transferred to the reserve fund account. The Chairman (Mr. J. Barrett), in moving the adoption of the report, referred to the satisfactory progress made in the business of the Company. They had had such a successful year that, had it not been for the increase in the cost of coal, they would have been able to reduce the price of gas. In conclusion, the Chairman mentioned that, owing to the increased consumption of gas last winter, it would be necessary to put up a new gasholder. The report was adopted, and the dividends recommended were declared. The Chairman, in proposing a vote of thanks to the Secretary and Manager (Mr. Alfred J. Edwards) and the staff for their services during the year, paid a high compliment to Mr. Edwards for his efforts in promoting the success of the Company. Mr. O. G. Walter, another of the Directors, seconded the proposition. Mr. R. Bruford, also a member of the Board, in supporting it, said that had it not been for the wise foresight of Mr. Edwards during the many years he had been connected with the Company, they would not be in the favourable position they were at the present time. The vote having been heartily accorded, Mr. Edwards, in reply, said it was a great satisfaction to him to know that his efforts were appreciated by gentlemen with whom he had had the honour of being associated for so many years. Few men were better served by a staff of assistants than he was; and he was glad to be able to say that the most cordial relations existed between them. A vote of thanks to the Chairman concluded the meeting.

A Good Store of Coal at Tunbridge Wells.

At the half-yearly meeting of the Tunbridge Wells Gas Company last Wednesday, the Chairman (Alderman W. H. Delves) devoted, as was to be expected, a good portion of his remarks to the subject of the rise in the price of coal. There was no report presented; and therefore he gave the proprietors an idea of the progress of the business. He said the Company had had a prosperous half year; but, as they were no doubt aware, coal had gone up considerably in price. Fortunately the Company had made their contract last year, and it would last until the end of September. They had, therefore, not felt the rise in the price of coal, and it had been no additional expense to the Company up to now. They hoped that having three months of the present half-year's coal in stock at the present price, the general increase would not affect them during the present year. Their coal up to June 30 had only cost them 5d. per ton more than during the corresponding period of last year. Oil had cost ⅛d. per gallon more; but this was set off almost entirely by the increased price of residuals. In fact, they had used more raw material by about 400 tons of coal and 10,000 gallons of oil than in the corresponding half of last year; but, taking into consideration the price received for residuals, the cost was within £40 of that incurred during the corresponding period of last year. Taking the net cost per 1000 cubic feet of gas, there was a slight decline. They reduced the price of gas last year by 2d. The present price was 2s. 8d.; and the sale of gas during the half year had reduced the income of the Company by £1150, which remained in the pockets of the consumers. The increase in the quantity of gas sold, however, had considerably counteracted the loss resulting from the reduction in the price of gas. With the increase of 4½ million cubic feet of gas, the total rental had been reduced about £500. The additional sale had been about 3⅓ per cent., which was a very gratifying increase over last year. The prospect of the Company was a favourable one, and he quite looked forward to the hope that when he met the proprietors again they would be able to show a satisfactory balance-sheet for the current twelve months. The crucial position would be next year. The Company had paid for their coal this year; and though the advance in price was something like 3s. a ton, they hoped they would be able to hold out until the present excitable state in the coal market had subsided, and there were more reasonable prices. The demand for coal at present was very great from abroad, where enormous quantities had been bought to be used in competing with our own manufacturers. One could not see the policy of this; and it seemed a suicidal thing that we should supply foreigners, and that they should compete with our own industries. In conclusion, the Chairman proposed that an interim dividend as last year—viz., at the rates of 12 per cent. on the ordinary stock, 9½ per cent. on the "B" stock, and 9 per cent. on the "C" and "D" stocks—should be declared. This, less income-tax, came out at £5529. The motion was carried, and the proceedings closed with a vote of thanks to the Chairman.

THE PROPOSED FEDERATION OF POTTERY TOWNS.

Financial Proposals.

In connection with the suggested federation of towns in the Potteries, to which reference has already been made in the "JOURNAL," the following financial proposals, prepared by Alderman F. Geen, have been submitted to the various local authorities.

1.—For a period of ten years there shall be differential rating; each town being a rating area.

2.—An account shall be prepared for each town, as on the day upon which the new borough comes into existence, of its liabilities other than loans or the balance of loans raised under any Local Act of Parliament or sanction of the Local Government Board, and such assets, excluding sinking funds, as may have been acquired direct out of revenue. All such assets shall be taken over by the new borough, and dealt with as provided for under clause 3.

3.—Should the assets of any town exceed its liabilities, one-tenth of the difference shall be raised annually for ten years by all the towns in proportion to the rateable value, and applied in reduction of the rates of the town possessing the excess assets, as provided for in clause 4. Should the liabilities of any town exceed its assets, one-tenth of the difference shall be raised annually for ten years by such town, and applied in reduction of the rates of all the towns in proportion to rateable value, as provided for in clause 5. The assets and liabilities to be dealt with under this clause are those to be included in the account referred to in clause 2.

4.—During the period of differential rating, each area shall be credited with (*a*) the sums, if any, receivable under clause 3; (*b*) all grants receivable from the National Exchequer as at present; (*c*) its proportion, based on rateable value, of grants in respect of local taxation, licence duties, &c., estate duty, and customs and excise duty; (*d*) profit, if any, on its industrial undertakings; (*e*) moneys receivable as at present in respect of cemetery, baths, town hall, markets, shops, and other properties, private street improvements, &c.

5.—During the period of differential rating, each rating area shall be debited with (*a*) the sums, if any, payable under clause 3; (*b*) loss, if any, on its industrial undertakings; (*c*) interest on loans and repayments of principal; (*d*) all moneys expended thereon, as at present, except that a proportion only, based on rateable value, of such administrative charges as are common to the new borough shall be debited.

6.—Each rating area (except Hanley, which has already had its adjustment) shall be credited or debited, as the case may require in proportion to rateable value, with any sum or sums receivable from, or payable to, the Staffordshire County Council in respect of any adjustment made between that Council and the new borough.

7.—During the period of differential rating, separate accounts shall be kept for each rating area, and rates to cover the difference between the sums debited and credited shall be levied on each area in accordance with the scheme above outlined.

8.—After the period of differential rating, all income and expenditure shall be common to, and uniform rates levied throughout, the new borough.

THE CENTENARY OF GAS LIGHTING.

[From the "Daily Telegraph," Aug. 16.]

It is exactly one hundred years ago to-day that the first street in London, or, for the matter of that, in the world, was lighted with gas. As with many epoch-making events, this great advance in urban civilization was ushered in with something like humility. For it was not one of London's great thoroughfares nor one of its fashionable haunts that thus led the way in street lighting, but a little byway in Aldersgate—Golden Lane, to wit. True, it was a district rich in historical association, for near by Prince Rupert had lived and worked at his chemical experiments and the new mode of engraving, since called mezzotint—a method which has produced in our midst many excellent artists. Very close by, too, had stood the Fortune Theatre, where Henslowe and Alleyn had produced so many of the great dramas which that wonderful time was giving the world; and on the very spot had stood Tom Killegrew's Nursery, the first dramatic academy in our country, and probably in the world. But none of these things were of such far-reaching and lasting effect as the event of a hundred years ago, inaugurated with no fuss or ceremony, and the very memory of which has now to be hunted out of all but forgotten journals, magazines, or volumes of reminiscences.

As with most new departures, there is some dispute about the facts, and some contradiction even among those who profess to have been actual eye-witnesses. Thus, J. R. Planché, Somerset Herald, and long a popular writer for the stage, tells us: "On Jan. 28, 1807, I had wandered down Pall Mall with my father, and seen the first lamps lighted with gas in London." This is misleading, both as to the fact and the implication. The first gas-lamps lighted in London, apart from private experiments, seem beyond doubt to have been those shown in 1803 and 1804, at the Lyceum Theatre, by Mr. Winsor, a German scientist, who took out some patents and tried hard to float a company for lighting London with coal gas, but failed to obtain the necessary Act of Parliament. . . . The lights which Planché saw were most probably at Winsor's shop in Pall Mall, adjoining the garden wall of Carlton House on the east. On the King's birthday, this pioneer gave what was then a grand display on the wall between St. James's Park and Carlton House Gardens. Thirty-two lights were shown—some naked, some covered with glass—a Prince of Wales's feathers in gas over the private door to the garden, and an illuminated transparency over another gateway. A contemporary account of this exhibition concludes: "Hopes may now be entertained that this long-talked-of mode of lighting our streets may at length be realized. The Mall continued crowded with spectators until near twelve o'clock, and they seemed much amused and delighted by this novel exhibition."

The proprietors of the Golden Lane Brewery made the first effort in the permanent lighting of a public thoroughfare by gas on Aug. 16, 1807. The gas was made on the brewery premises. Seven lamps were fixed in Golden Lane, and four in Beech Street, at distances of about 20 yards. This experiment seems to have been entirely successful.* Finsbury Square is stated to have been the next public place in London to adopt the new illuminant, and Grosvenor Square (which did not discard its oil-lamps till 1842) the last. It was five years, however, before a company was established for the supply of gas. When this was done, its use spread with such rapidity that in less than ten years the new method of lighting was general in London, and had spread to most of the chief cities in England and abroad.

THE COST OF TARRING ROADS.

The Local Government Board have communicated to the Lindfield (Sussex) Parish Council a decision upon tarring roads to lessen the dust nuisance brought about mainly by motor traffic, which will cause consternation throughout East Sussex. A short time since, the East Sussex County Council notified the rural districts that they were prepared to tar-spray roads if the local Councils would guarantee half the cost. Many of the Councils accepted the offer—Lindfield among the number. A long length of road was tarred, the half cost of which was £25. The Local Government Board have now written to say that they cannot see their way to sanction this amount being made a special charge upon the parish. If this decision is adhered to, the individual members of the Council will have to refund the money. In the House of Commons, on Monday last week, Mr. Lonsdale, the Member for Mid Armagh, asked the President of the Local Government Board whether he was aware that Rural District Councils desired to co-operate with County Councils in the mitigation of the dust nuisance by spraying the roads with tar; whether the Board had decided that the first-named Councils could not incur expense in this direction; and whether some modification of the decision was possible. Mr. Burns said he was aware of the desire referred to. He presumed that the roads to which the hon. member alluded were main roads. Those in rural districts were maintained by the County Council; and the question was whether a Rural District Council could legally contribute towards the cost of spraying them with tar. They could do so if the operation could be brought within the terms of section 3 of the Highways and Bridges Act, 1891; but he was advised that it could not safely be held that this was the case. He added, in answer to a further question, that this was one of several matters which he hoped to be able to go into during the recess.

HALIFAX WATER SUPPLY.

Approaching Completion of the Walshaw Dean Reservoirs.

It is expected that within the next few months the water supply of Halifax and district will receive an important addition by the completion of the reservoirs of the Corporation at Walshaw Dean, the Engineers for which are Messrs. G. H. Hill and Sons, and the Contractor is Mr. Enoch Tempest.

The decision to construct the new reservoirs was come to about seven years ago, not, however, without encountering considerable opposition. Their completion will give an available daily supply of 2½ million gallons; bringing up the total for the Corporation's water-works system to about 8 million gallons per day. Consequently, Halifax will be assured for many years against danger from shortage of water; indeed, for some time to come it will have a good deal more than it requires. Already Morley has entered into an agreement with Halifax for the sale of a quantity of water. The site of the new reservoirs is a valley on Walshaw Moors, 1150 feet above the sea level. They are three in number, lying one behind the other, and having a total length of 1½ miles. The combined capacity of the reservoirs is 650 million gallons; and their surface area is upwards of 100 acres. The total drainage area is 2352 acres—almost all moorland. The upper reservoir will hold 214 million gallons, and has a depth of 75 feet; the middle reservoir, with a depth of 78 feet, will contain 266 million gallons; and the lower reservoir (the smallest) has a holding capacity of 141 million gallons and a depth of 76 feet. The middle reservoir will be chiefly used for supplying the town; but provision has been made to draw water from any one of the three. The compensation water will be about one-third of the daily supply, or nearly 1,600,000 gallons daily. This is just about the same as that from the Widdop reservoir; the only difference between the two cases being that the compensation from Walshaw Dean is to be continuous, instead of during only the twelve hours of the day. The compensation stream will pass through a gauge basin at the bottom of the lower embankment. There is a discharge tunnel at each embankment; and it is possible to draw off water at three levels from valve-shafts, which will be connected with the embankments by light girder bridges. Each reservoir is provided with an overflow into a flood watercourse which skirts the upper and middle reservoirs, and carries water straight away for compensation purposes. By means of this watercourse, the town's supply is kept clear at times of storm flood. The water from Walshaw Dean is to be conveyed by a new conduit as far as Holme End, half-a-mile away, where the iron syphon pipes from Widdop are joined.

It is expected that the final cost of reservoirs will be upwards of £350,000, exclusive of the cost of land and water rights purchased from Lord Savile for £30,000. Up to Dec. 31, 1906, the actual capital expenditure on works was £299,616; and from that date to July 31 last an additional £60,000 was paid to the Contractor. The total borrowing powers amounted to £280,097; and these were exhausted on June 1 last.

* This installation was mentioned in the first of the articles on "The Centenary of Gas Lighting" (see *ante*, p. 87), which are concluded to-day.—ED. J.G.L.

The money required since tbat date has all been borrowed under the sanction of the Local Government Board. The uncertainty as to the ultimate cost is due to a dispute between the Engineers and the Contractor in regard to the latter's claim of £77,000 for extras. The settlement bas been postponed until the works are finished, when it is hoped a satisfactory arrangement will be possible. The original contract was for £172,335. In August, 1901, the Council confirmed a resolution to spend £2000 extra in beaching the sides of the reservoirs below the depths specified in the contract; and in May, 1904, they agreed upon a further sum of £8000 for taking out the peat from the inside of the reservoir—bringing the total amount of the contract to £182,335. The disparity between even this sum and the actual cost has been brought about mainly by the great depths to which the three puddle trenches have had to be carried before really water-tight foundations were reached. At first, it was expected that a depth of 60 feet in each case would be sufficient. But as the work proceeded a great fault in the strata was discovered running diagonally across the valley—the result being that the three trenches now vary from a depth of 80 feet to 160 feet. Then another fault was discovered at the end of one of the main trenches; and this compelled the construction of a wing trench at an expenditure of £8000. The largest part of the extras claimed by the Contractor is a sum of nearly £44,000 for excavating and puddling the trenches.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

It may be remembered tbat some time ago, a Committee of the Selkirk Town Council were appointed to consider as to the acquiring of the undertaking of the Selkirk Gas Company. This Committee, founding upon a report to them by Mr. W. R. Herring, of Edinburgh, recommended that the Company be offered £10,087 for tbeir undertaking. A week or two ago the Chairman of the Company stated, at the annual meeting, that the Directors had rejected the offer without consulting the shareholders, as it was quite inadequate and out of all approximation to the valuation by another expert, who had put the price at about £25,000. But after the annual meeting the Company made an offer of their whole undertaking to the Town Council for £15,000. This offer has been under consideration by a Committee of the Council, who have recommended that it be rejected, but that a further offer be made to the Company of the payment of annuities at the rate of 12½ per cent. upon the present share capital of £4500, by means of bonds, not bearing interest, for £15 per £5 share, payable in thirty years. These annuities will amount to £562 10s. a year, and in thirty years to £16,875, or £1875 more than the offer of the Company, but spread over thirty years. As the Company pay 10 per cent. per annum, the benefit to the shareholders by the recommendation of the Committee would be only 2½ per cent. per annum for thirty years. A writer upon the subject says that though it may be impossible to say what the actual present value of the Committee's recommendation is in cash, it may probably be put at £13,500, on the basis that a £15 bond is given for every £5 share. "The discussion of the matter," it is said, "will be followed with interest; but before the burgh take the business—if it be decided to take it—the question must be submitted to the ratepayers, and an election fought on it. The present price of gas is only 2s. 6d. per 1000 cubic feet; and unless the municipalizers can show that they can supply it equally good and cheap, and add no more to the municipal burdens, the public are not likely to entertain the scbeme. The valuation of the Company's property in their annual balance-sheet is over £20,000; so that it is by no means certain that they will entertain the offer proposed to be made, which is so very much lower."

At Peterhead, on Monday, Bailie Birnie presented the accounts of the Gas Department for the past twelve months. The year had been the most favourable for them since the works became the property of the town. The gas produced had been 42,878,900 cubic feet—an increase over the previous year of 3,648,300 cubic feet; the increase requiring only 47 tons more of coal. The revenue from the sale of gas was £6101; from residual products, £1535; and from rents, £60; a total of £7695. Coal, including freight and cartage, had cost £77, and stokers' wages £11 more; but the total salaries were £29 less. In maintenance they bad a saving of £154, at no sacrifice of efficiency. There were now 1453 ordinary and 1005 prepayment consumers—2458 in all. Neitber class was charged a higher rate than the other. They were at the present time improving the storage accommodation, and would now have a works which would not be surpassed by any town of its size. Mr. Samuel Milne, of Aberdeen, had valued the works at a figure which was very satisfactory; being £6531 more tban the previous valuation. The year closed with a profit of £900, notwithstanding a considerable reduction in the price of gas at the commencement. But for the saving effected in the estimated consumption of coal, and the available balance of coal at last year's prices, it would have been necessary to increase the price of gas this year, as, assuming the same consumption, the advance in the price of coal would have meant an additional expenditure of £602. He proposed that £500 be set aside as a reserve fund, and that the balance be used in providing a new roof to the retort-house, and other repairs. The Convener expressed the appreciation of the Committee of the loyal service of the gas-works employees, and said he thought it would be a graceful act to give the Gas Manager a similar salary to that paid to the former Manager before he left—viz., £170. This was agreed to, as was also the adoption of the accounts.

The thirty-first annual meeting of the Penicuik and District Gas Company was held on Tuesday. A profit for the year of £519 was reported. It was agreed, after paying a dividend of 5 per cent. upon the preference sbares, to pay a similar amount on the ordinary shares, free of income-tax.

At the monthly meeting of the Johnstone Gas Commissioners on Monday, it was stated that it was estimated that if the prices of gas were continued at the same rates as last year, there would be a deficiency on the twelve months' working of £538. The Commissioners agreed to raise the price by 2d. per 1000 cubic feet; making it 2s. 6d. per 1000 cubic feet for lighting, and 2s. 4d. for power.

At tbe International Exhibition on School Hygiene, lately held at the Imperial Institute, Messrs. A. E. Podmore and Co. were awarded a bronze medal for their dust-proof bunsen burner incandescent gas-lamp.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 496.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	"	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6½—7	..	5 0 0
40,000	5	"	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Feb. 28	14	Bournemouth Gas and Water 10 p.c.	27½—28½	..	4 18 3
51,810	10	"	7	Do. B 7 p.c.	16½—17	..	4 2 4
53,200	10	"	6	Do. Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	245—250*	+1¼	5 0 0
300,000	"	"	9½	Do. New	185—190*	+1¾	5 0 0
50,000	"	"	5	Do. 5 p.c. Pref.	115—120*	+½	4 3 4
706,250	"	June 13	4	Do. 4 p.c. Deb.	100—105	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	"	"	8¼	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	116—119*	..	5 0 10
165,700	"	"	4½	Do. do. 3½ p.c.	87—90*	−¾	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 12	8¼	Cagliari, Ltd.	26—27	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	106½—108½*	..	4 12 2
1,443,280	Stk.	"	5 2/10	Commercial 4 p.c Stk.	103—106	..	4 16 4
560,000	"	"	5	Do. 3½ p.c. do.	100—105	..	4 15 3
475,000	"	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	"	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	"	"	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk.	123—125	..	4 8 0
55,000	"	Jan.	4	Do. Deb. Stk.	102—104	..	3 16 11
486,090	"	July 31	12	European, Ltd.	22½—23½	..	5 2 2
354,060	"	"	12	Do. £7 10s. paid	17½—18½	..	4 17 4
15,181,590	Stk.	Aug. 15	[illegible]	Gas-light and Coke 4 p.c. Ord.	92—94*	..	4 13 6
2,600,000	"	"	3½	Do. 3½ p.c. max.	86—88*	..	3 19 7
3,799,735	"	"	4	Do. 4 p.c. Con. Pref.	102—105*	..	3 16 2
4,193,975	"	June 13	3	Do. 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	"	"	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	173—175	..	4 11 5
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93*	..	3 15 3
184,602	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
306,083	"	June 27	4	L'pool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A	222—224	+1	4 9 3
718,100	"	"	7	Do. B.	164—165	..	4 4 10
152,736	Stk.	Feb. 14	7⅝	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	"	4½	Do. 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Cor.	107—108*	+¾	4 5 7
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb	92—93	−1	3 15 3
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	"	7	Do. 7 p.c	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord.	6¾—7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref.	4⅝—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	12¾—13¼	..	6 0 9
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	246—248	..	4 0 8
209,984	"	"	10	Do. B	246—248	..	4 0 8
523,500	"	"	10	Do. C	246—248	..	4 0 8
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	118—120*	+¼	4 11 8
1,895,445	"	July 12	3	Do. 3 p.c. Deb.	81—83	−1	3 12 3
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159—161	..	4 19 5
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c	115—118*	..	4 13 3
60,000	"	"	5	Do. 5 p.c. Pref.	117—120*	−½	4 3 4
117,058	"	July 12	5	Do. 5 p.c. Deb. Stk	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Aug. 15	6¾	Tottenham and Edmonton A 5 p.c.	120—125*	+⅜	5 9 9
398,940	"	"	5¼	Do. B 3½ p.c.	98—101*	+⅜	5 4 0
149,470	"	June 27	[illegible]	Do. 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red	100—102	..	4 15 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c.	—	..	—
255,636	"	Aug. 15	6½	Do. B 3½ p.c.	128—133*	+¼	4 17 9
75,000	"	"	5⅜	Do. C 3½ p.c.	—	..	—
80,075	"	June 27	3	Do. 3 p.c. Deb. Stk	77—80	..	3 15 0
845,872	"	Aug. 15	5⅛	West Ham 5 p.c. Ord.	99—102*	−⅜	5 0 6
185,000	"	"	5	Do. 5 p.c. Pref.	118—120*	+½	4 3 4
228,300	"	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div."

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 17.

Sulphate of Ammonia.

There has been no material alteration in the situation during the week, demand being still mainly for the purpose of covering contracts, and fresh business being in limited compass. The available supply, however, is being absorbed; and the closing quotations are £11 15s. per ton f.o.b. Hull, £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. The forward position presents no new feature. While makers generally seem to be indifferent in regard to selling for spring delivery and maintain their quotations at £12 2s. 6d. to £12 5s. per ton, buyers' views are scarcely above the level of £12 per ton. For delivery up to the end of the year, spot prices would be paid; but these do not afford sufficient attraction to makers.

Nitrate of Soda.

This article remains quiet, but firm, at 11s. 1½d. to 11s. 4½d. per cwt., according to quality, on spot.

LONDON, *Aug.* 17.

Tar Products.

The market for tar products is still quiet, and there does not appear to be much hope of any great revival in business for the next week or two. Pitch remains in about the same position. There is no inclination on the part of Continental consumers to purchase at anything like the prices asked by makers in England; but it is possible that they will be more disposed to buy a little later on. In South Wales, business is reported to have been done at very low figures to the end of 1908. It is, of course, very difficult, if not almost impossible, to ship pitch at the present time of year; therefore the prompt values are to a certain extent nominal. For forward delivery, manufacturers on the east coast ask from 28s. to 28s. 6d. per ton, and equivalent prices are quoted elsewhere, but at present they cannot do business at these figures. Creosote is very firm, and values are well maintained. Benzol, 90 per cent., is weak; business having been done at the best ports on the east coast at 8d. per gallon, casks included. Benzol, 50-90's, and toluol are both very quiet indeed, there being little demand for either quality. Solvent naphtha is quiet in the North, but fairly steady in London, where actual London makes are in fair demand. Carbolic acid is steady. Continental consumers refuse to offer more than 1s. 8d. on the east coast; but manufacturers report that they are disposing of their parcels at a rather better figure than this. Crystals are dull, and hard of sale. In anthracene, a parcel has been sold during the last few days at 1½d. per unit, delivered to consumers' works.

The average values during the week were: Tar, 15s. 6d. to 20s. Pitch, London, 26s. nominal; east coast, 25s. to 25s. 6d.; west coast, 23s. 9d. to 24s. 9d. Benzol, 90 per cent., 7½d. to 8½d.; 50-90 per cent., 8½d. to 9d. Toluol, 10d. to 11d. Crude naphtha, 4d. to 4½d.; solvent naphtha, 1s. to 1s. 2½d.; heavy naphtha, 1s. 1d. to 1s. 3d. Creosote, London, 2⅞d. to 3d.; North, 2½d. to 2⅝d. Heavy oils, 3d. to 3⅛d. Carbolic acid, 60 per cent., 1s. 8d. to 1s. 8¼d. Naphthalene, £6 10s. to £12 10s.; salts, 35s. to 40s. Anthracene, "A" quality, 1½d. to 1⅝d.

Sulphate of Ammonia.

This article is steady. There is not very much business doing, and values are practically unchanged. The principal London Gas Companies still ask £12 2s. 6d. to £12 5s., but other makes can be bought upon Beckton terms for prompt delivery at £11 13s. 9d.; while £11 15s. to £11 17s. 6d. may be taken as the free alongside values in London. In Leith, business has been done again at £12, and the market is steady; most manufacturers asking £12 2s. 6d. In Hull, there is not much business doing; and the value may be taken as about £11 13s. 9d. to £11 15s. In Liverpool, sales are reported to have taken place at £11 16s. 3d. to £11 17s. 6d.

COAL TRADE REPORTS.

Lancashire Coal Trade.

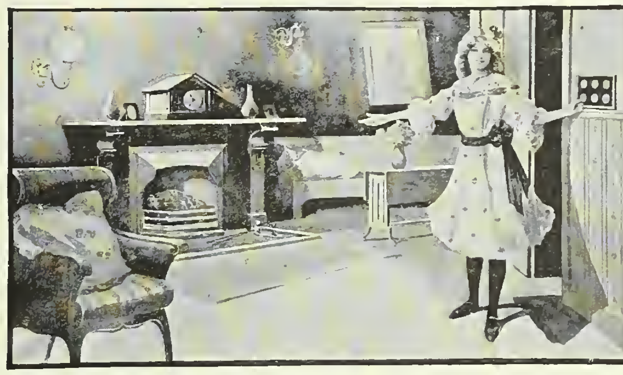
There is nothing really new, and no change, to report with regard to the Lancashire coal trade since our last issue, except that the wages of the operative miners are to be increased another 5 per cent. from Sept. 13. The trade continues as strong or stronger than ever. The summer season has made no perceptible effect on the output. There is no accumulation of stocks; and no reductions in prices. We know of one firm of colliery proprietors in the Manchester district who, having made terms with a consumer for a renewed steam coal contract at an advance of 2s. 6d. per ton on his contract of 1906, refused an offer by the same gentleman for a further supply of 50,000 tons at another 6d. per ton increase in the price. There are orders for shipping coal too heavy to be met by some of our coal owners. Gas coal and cannel, however, are rather quiet. The volume of trade done at the coal tips at Cadishead on the Ship Canal is greater than ever. More tips are wanted. The total weekly shipments average between 20,000 and 30,000 tons, the bulk of which comes from Lancashire collieries. Yorkshire and Derbyshire coal is also shipped in large quantities.

Northern Coal Trade.

There is now a very strong demand for coal; and where immediate or early delivery is needful, the range of prices is firm all round. There are now more negotiations for sales for next year's delivery. In the steam coal trade, best Northumbrians are firm at from about 16s. to 16s. 3d. per ton f.o.b., second-class steams are 15s. to 15s. 6d., and steam smalls are 10s. to 10s. 6d. The production is fair for this season—in which there are often local holidays—and is well taken up. In the gas coal trade, there is a fuller inquiry, the home consumption now showing an increase, and the exports continue very heavy. The collieries therefore are well drawn upon, and there is comparatively little fuel free for early sale. The prices quoted are from 13s. 9d. to 15s. per ton f.o.b. for gas coal, according to quality, with occasionally a

ELECTRIC LIGHT SUPERSEDED.

PNEUMATIC DISTANCE GAS LIGHTER.



A FEW RECENT INSTALLATIONS.

BUILDING.	Installed by
Madam Tussaud's, London	GASLIGHT AND COKE COMPANY, LONDON.
Bethnal Green Fire Station (L.C.C.)	
The Albany, Piccadilly, W.	
St. Martin's Hall, Gospel Oak	
Aberdare Gas Company's Offices	LOCAL GAS COMPANIES.
Carmel Chapel, Aberdare	
Miles & Sons' Restaurant, Aberdare	
Christ Church, West Bromwich	
Baptist Chapel, Redhill	
Christ Church, Wallington	
Holy Trinity Church, Wallington	
Baptist Chapel, Woodside	
Radcliffe Theatre, Radcliffe, Lancs.	
Theatre Royal, Chorley,	
St. Giles' Church, Willenhall	
Two Churches in Cardiff	
Town Hall, Banbury	
St. Luke's Church, Bath	
St. Paul's Church, Bath	
Monkton Combe Church, Bath	
Conservative Club, Bath	
Constitutional Club, Bath	
Jolly's Establishment, Bath	
Conservative Club, Ventnor	
Bathgate Church	
Masonic Lodge, Brisbane, Australia	
St. Patrick's Cathedral, Auckland, N.Z.	
New Council House, Smethwick	PNEUMATIC GAS LIGHTING CO.'S FITTING DEPT.
Royal York Hotel, Margate	
St. Martin's Church, Bedford	
St. Paul's Church, Haggerston, N.E.	
Angel Hotel, Henley-on-Thames	
Red Lion Hotel, ,,	
Phyllis Court Club, ,,	
Club House, Datchet	

PNEUMATIC GAS LIGHTING CO., LTD.,

36, Farringdon Street, E.C.

Telephone 2123 HOLBORN. Tele. Address: "OMNIBUSSES, LONDON."

higher figure for one or two kinds. There is not much doing in ordinary contracts at present; but sales are now being concluded for export quantities for forward shipment. In one case, a lot has been sold for export to Italy over next year at a price that is expected to allow about 14s. 3d. per ton f.o.b. for best Durham gas coals. The coke trade is firm, and gas coke is strong; but there is now an increasing output. From 19s. to 20s. per ton f.o.b. is the current quotation for good gas coke.

Scotch Coal Trade.

Trade has been very active; foreign buyers being apparently anxious to stock coal before the winter sets in. The shipping trade is, in consequence, exceptionally busy. All classes are in demand; and ell is reported to be scarce. The prices quoted are: Ell 13s. to 15s. per ton f.o.b. Glasgow, splint 14s. to 14s. 6d., and steam 12s. 9d. to 13s. The shipments for the week amounted to 342,828 tons—an increase of 32,598 tons upon the previous week, and of 19,884 tons upon the corresponding week of last year. For the year to date, the total shipments have been 8,791,399 tons—an increase of 596,558 tons.

Gas Supply in North London Suburbs.

At the half-yearly general meeting of the Southgate and District Gas Company next Thursday, the Directors will report an increase of 5,348,700 cubic feet, or 10 per cent., in the sale of gas in the six months ending the 30th of June. The total sales amounted to 58,227,500 cubic feet; and the net revenue therefrom was £10,674. The receipts for the half year were £12,877, and the expenses £9924; leaving a balance of £2952. After charging interest on debenture stock, &c., there is a sum of £4337 available for distribution; and the Directors recommend the declaration of dividends for the half year at the maximum rates of 5, 10, and 7 per cent. per annum on the preference, original, and additional capital respectively. These payments will absorb £2478, and leave £1859 to be carried forward. In the case of another Company which may now almost be regarded as a North Suburban one—the Waltham Abbey and Cheshunt Gas Company—the quantity of gas sold in the six months ending the 30th of June showed an improvement; and there was a satisfactory increase in the amount received for residuals. The revenue was £7349, and the expenditure £4971; leaving £2378 to be carried to the profit and loss account. The net profit for the half year was £2769; and at the recent half-yearly meeting dividends at the rate of 8½ per cent. per annum on the "A" shares, and 6½ per cent. per annum on the "B," "C," and "D" shares were declared. These, together with the debenture stock interest, required £2322, and left £447 to be carried forward.

Rhyl District Council Gas Undertaking.

The Gas Engineer and Manager of the Rhyl Urban District Council (Mr. Leonard G. Hall) has presented to the Gas Committee his working statement for the year ending the 31st of March. It shows that the gross cost of gas was £5962; being at the rate of 28·04d. per 1000 cubic feet of gas sold and 24s. 5·13d. per ton of coal carbonized. The net-cost figures are £4244, 19·96d., and 17s. 4·64d. respectively. The revenue from gas was £9007, being 42 36d. per 1000 cubic feet of gas sold and 36s. 10·81d. per ton of coal; and the profit on revenue account was £4763, being 22·4d. per 1000 cubic feet of gas sold and 19s. 6·17d. per ton of coal. The total make of gas was 54,429,500 cubic feet, of which 46,181,200 cubic feet, or 84 85 per cent., were sold for private consumption, and 4,844,500 cubic feet, or 8·9 per cent., for public purposes. The unaccounted-for gas was 5·1 per cent., against 6·27 per cent. in the year 1905-6. The make of gas was at the rate of 11,148 cubic feet per ton of coal carbonized; and 10,452 cubic feet per ton were sold. The working statement did not include expenditure or income on cookers, fittings, or new meters, nor an item of £391, the second instalment, paid out of revenue, for a new retort-bench—these not being items of the revenue account. The interest on the loan amounted to £1181 10s. 7d.; and the sum set aside for redemption was £1429 2s. 7d.—making together £2610 13s. 2d. Referring to the statement at the last monthly meeting of the Council, Mr. Perks commented on its extremely favourable character, particularly in regard to the reduction in the unaccounted-for gas, which he pointed out had been brought down to the low figure of 5·1 per cent., and the satisfactory yield of 11,148 cubic feet of gas per ton of coal carbonized. The Gas Committee congratulated Mr. Hall on the highly satisfactory result of the year's working, and expressed their warm thanks to him for the ability and zeal he displayed in performing the duties of his office. It was resolved that he should report fully to the Committee on the adequacy of the plant to meet present and future demands for gas.

Dawlish Water Supply.—The members of the Dawlish District Council paid their annual visit of inspection to the water-works last Wednesday. It was stated in the course of the proceedings that the works had been established for thirty years, and had given great satisfaction. In 1910 the original loan of £10,526 will be paid off, and the capital indebtedness on the undertaking will then be very small. Mr. J. Shapter, the Chairman of the Water Committee, said that when this position was reached the Council would no doubt consider the question of improving the supply and constructing storage works.

Rand Water Board.—The report and accounts of the Board for the year ended the 31st of March last have been submitted to the Colonial Secretary of the Transvaal. They show that the revenue was £161,936, while the expenditure amounted to £147,068; leaving a surplus of £14,868. Out of this sum, £10,226 is placed to the machinery and plant renewal fund; leaving an unappropriated balance of £4642. The total quantity of water supplied during the year amounted to 1,020,908,000 gallons, of which 826,846,000 gallons, or 85 per cent., were sold to municipal authorities, and 151,056,000 gallons, or 15 per cent., to mining companies. Of the total quantity sold, 792,165,000 gallons were used in Johannesburg, 212,147,000 gallons on the East Rand, and 16,596,000 gallons on the West Rand. The charge for water was reduced on Nov. 1 from 3s. 6d. to 3s. per 1000 gallons in anticipation of an increased demand which did not arise.

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NELSON METER WORKS,
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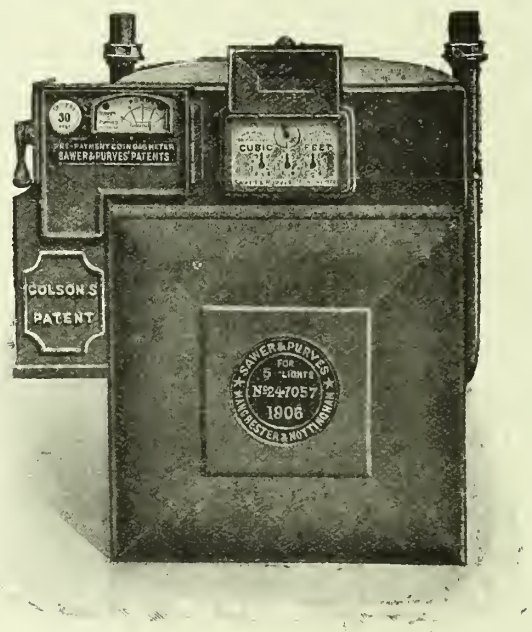

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Skegness District Council and the Water-Works.—Under advice from their Consulting Engineer, the Skegness Urban District Council have decided to promote a Bill next session to authorize them to purchase the undertaking of the Skegness Water Company, and to make further and better provision with regard to the improvement, health, local government, and finance of the district.

Colwyn Bay Water Supply.—The Cowlyd Water Board are preparing to apply to Parliament for an Act to sanction the abstraction of a larger quantity of water than is at present allowed by the terms under which they obtained the freehold of the lake and watershed from Lords Ancaster and Newborough. The Board have also decided that, as soon as the Bill is passed, the laying of an extra main to Colwyn Bay will be proceeded with.

Sussex Town in Darkness.—The Hurstpierpoint (Sussex) Council, after several meetings and interviews, have refused to accept the Gas Company's terms for lighting and extinguishing the public lamps; and, there being no other lighting authority in the district, the town is in darkness. At a Council meeting on Saturday night, the Chairman, Mr. A. Weekes, J.P., said the matter was becoming a scandal. Ladies had to take bicycle lamps with them to find their way about; and there was danger of accidents. A motion to compromise with the Company was defeated.

The Award in the Neyland Gas Arbitration.—The Pembroke Dock and Town Gas Company have taken up the award of Mr. W. A. M'Intosh Valon, the Umpire in the arbitration proceedings (see *ante*, p. 339) to determine the amount to be paid by the Neyland Urban District Council for the works, mains, and plant of the Company situated within their district. The Company claimed £3003 18s. 3d.; and the Council offered £1300. The amount awarded is £1704 5s. 5d.; being £1597 for the purchase of the mains, pipes, and works, and £107 5s. 5d. for additional works carried out after the notice to treat.

The Recent Accident at the South Suburban Gas-Works.—The accident which occurred at the South Suburban Gas Company's works on July 12 ended last Wednesday in the death of the workman concerned. On the day in question, it may be remembered, a fire occurred in one of the gasholders, which was being enlarged by a Leeds firm of contractors. After the fire had been extinguished, work was resumed until a riveter's "holder-up," named Edward Tyler, aged 35, living at Leeds, had a terrible fall—pitching headlong into the empty well of the holder, between the iron plating of the telescopic partitions. When picked up in an unconscious condition, he was removed to Lewisham Infirmary, and he remained there till his death occurred at 10.30 a.m. last Wednesday. Tyler was a married man with two children.

Warrington Corporation Gas Supply.—The Gas Engineer to the Warrington Corporation (Mr. W. S. Haddock) has presented to the Gas Committee his nineteenth annual report. In the course of it, he points out that the large increase in the item of coal and cannel shown by the accounts is due to an advance in price and much larger consumption; and he says the higher cost of the raw material and the reduced price of gas will probably reduce the profits next year by £5000 or £6000. The increased make of gas in the year covered by the report was 28,595,800 cubic feet, or 6·9 per cent. more than in the preceding year. The statement of expenditure and revenue shows that the total expenditure for the year was £51,637, and the total revenue £74,876; leaving a gross profit of £23,239. The gross profit in 1906 was £22,974. Out of the gross profits, however, have to be paid annuities, interest, and an amount to the sinking fund, coming altogether to about £8000. The greater portion of the balance goes to the relief of the rates.

New Joint-Stock Companies.—The Plaissetty Manufacturing Company, Limited, has been registered with a capital of £75,000, in £1 shares, to acquire from Messrs. T. Terrell and J. P. H. Soper inventions in respect of incandescent filaments and mantles and burners for use in connection with mantles or lighting, and patents and rights relating thereto, together with the business and assets of the Plaissetty Manufacturing Company, at Lewisham; to adopt an agreement with the above-named gentlemen; and to carry on the business of manufacturers of, and dealers in, mantles, threads, filaments, silks, and other materials or apparatus for incandescent lighting, lamps, gas-fittings, &c. There will be no initial public issue. The Kippax and District Gas Company, Limited, has been registered with a capital of £15,000, in £1 shares, to acquire the business of gas manufacturers and suppliers carried on at Kippax, Yorkshire, as the Kippax Gas Company; to adopt an agreement with Mr. Robert Porter; and to manufacture, sell, and supply gas for lighting, heating, or other purposes in the parishes of Kippax and Great and Little Preston. Among the subscribers are Mr. R. Porter, the Gas Engineer, and Mr. B. Porter, the Assistant Gas Engineer, of the Elland Gas Company. There will be no initial public issue.

Gainsborough's Gas-Works Profits.—The gas undertaking of the Gainsborough Urban District Council has to its credit another successful year's working. The profit and loss account of the Gas Department was presented last week for the year ending March 31, showing receipts of £14,939 and expenditure of £13,821—a profit of £1118. During the year extra discount to consumers amounting to £334 was given. The work of improving the lighting of the town, by the conversion of ordinary street-lamps to the incandescent system, cost £200 more than the previous year. The quantity of gas made was 85,094,000 cubic feet—an increase of 1,806,000 cubic feet. The coal carbonized amounted to 7648 tons—an increase of 126 tons. The make of gas per ton of coal carbonized was 11,125 cubic feet per ton, or an increase of 53 cubic feet compared with the previous year. This satisfactory make of gas per ton of coal carbonized, the Chairman stated, has been brought about by the very close attention given by the Gas Manager (Mr. John Baldwin), and will compare favourably with other works in the country. The receipts from tar and ammoniacal liquor are less, but the aggregate income from residual products is slightly more. The number of meters now fixed is 2167, being an increase of 191 on the year. Gas cookers still continue to increase in popularity; the number in use to date being 560, or an increase of 128. Owing to the advance in the price of coal, over £900 of the profits made are earmarked.

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Guildford Water Supply.—The Guildford Corporation have applied to the Local Government Board for sanction to a loan of £56,296 for the purchase of the portion of the Woking Water Company's undertaking which supplies properties in Stoke. The loan is made up as follows: Arbitrator's award, £46,900; laying new mains for the Company, £3789; connecting mains with the Corporation works, £875; Arbitrator's charges, £354 10s.; taxed costs of the Company in the arbitration, £1767; Corporation's costs, £2566. At the inquiry into the matter on behalf of the Board, Mr. C. G. Mason, the Borough Engineer, said he estimated that in 1911 the supply would not only be ample to meet the needs of the whole area, but that there would be an excess of 300,000 gallons per diem. Dr. Thresh, who had been carrying out very careful experiments and analyses, described the water as excellent and of remarkable purity.

Progress of the Harrogate Water-Works.—The new water-works which the Harrogate Corporation are constructing at Roundhills are reported by a local paper to be going steadily forward, and making most satisfactory progress. The tunnel, when completed, will be more than three miles long. It was commenced in 1902, and up to the 25th of July last 5018 yards had been driven. The Engineer (Mr. E. W. Dixon) says that should the total rate of progress average 30 yards per week, the tunnel should be driven through in seven months. On the main dam, the difficulties in the wing-trenches having been overcome, good progress is being made. The estimated volume of masonry and concrete in the whole dam when completed is about 123,000 cubic yards, of which 54,000 yards have been executed. This is equal to about five-twelfths of the total work; so that with the tunnel nearly through, the settling reservoirs completed, the pipe-track laid, and all the difficulties of the trench settled, the completion of the scheme in three years from the present time may safely be prophesied.

South Molton Water Supply.—Early in the present year, the South Molton Town Council sought the advice of Mr. J. Siddalls, the Borough Surveyor of Tiverton, with regard to the improvement of the water supply. Mr. Siddalls recommended, among other things, the construction of new filters, and the covering of the service reservoir—pointing out that, owing to the defective construction of the present reservoirs, the water is really less pure after filtration than before it. The Town Council, however, came to the conclusion that action on the matter might be deferred, as the proposed expenditure (£3200) would mean an addition of 5d. in the pound to the rates. At a meeting of the Council last Tuesday, a letter was read from the Local Government Board, urging that the matter should receive further consideration with a view to putting the works into a thoroughly efficient condition. The Mayor (Mr. J. Sanders) proposed that an answer should be sent to the effect that the Council were prepared to proceed with the construction of new filter-beds. He said they had bought land for this purpose, having told the Local Government Board that the present filter-beds were inadequate; but they had let the land and had abandoned expert advice for that of members of the Council. The motion was lost; and it was decided to inform the Board that the Council were going to take steps to put the filter-beds in a satisfactory state of repair. The question was referred to a Committee. The Clerk pointed out that were money spent on repairs it would possibly be useless, as the Local Government Board might insist on the necessity for new beds.

The Directors of Messrs. Fletcher, Russell, and Co., Limited, announce an interim dividend at the rate of 10 per cent. per annum on the ordinary shares for the half year to the 31st of August.

With the current volume, the "Builder" commenced, in "The Student's Column," a series of well-written articles on "Modern Methods of Using Gas." In the last number the subject of factory lighting is dealt with; and three good examples are given, comprising a foundry lighted with high-pressure gas, a pattern-shop lighted with anti-vibration gas-fittings, and a tailors' shop lighted with high-pressure inverted burners.

The Water Committee of the Bolton Corporation have entered into the following contracts: With Messrs. John Best and Sons, Limited, of Edinburgh, for the construction of the Delph reservoir; with Messrs. Glenfield and Kennedy, Limited, for the supply and fixing of a valve-shaft, lining and stand-pipe, footbridge, sluice-valves, &c.; and with the Staveley Coal and Iron Company, Limited, for the supply of cast-iron pipes for the reservoir.

A report has been received from Mr. Albert Halstead, the United States Consul at Birmingham, by the Washington Bureau of Manufactures, with reference to an automatic chain-making machine, which has been perfected by the Gilbert Little Company, of Bradford. The Consul states that the idea is said to have originated in Canada, and for smaller sizes, to make chains for reaping and binding machines, it was somewhat of a success; but for heavier chains and larger sizes the machine had to be reconstructed and remodelled, and this is what has been done. He explains that the machine draws in a steel bar at one end, and the bar issues at the other in the form of a steel-link chain, completely assembled.

At the Westminster Palace Hotel last Wednesday, a meeting of the Coal Conciliation Board was held to consider an application by the miners for an advance of 5 per cent. in wages. The following resolution was agreed to: "That the present rate of wages be advanced as from the first making-up day after Sept. 13 by 5 per cent. on the standard. Such advance is not justified by the figures, but is given in the belief that there is a rising market; and it is agreed between the parties that this advance shall not disturb the relations which have hitherto subsisted between wages and selling prices. That the above resolution applies to the wages of all underground labour and to the wages of all surface labour on the pit-bank and screens engaged in manipulating the coal as heretofore." This advance brings wages up to 2½ per cent. above the advances obtained in South Wales. It is the third increase of 5 per cent. granted this year.

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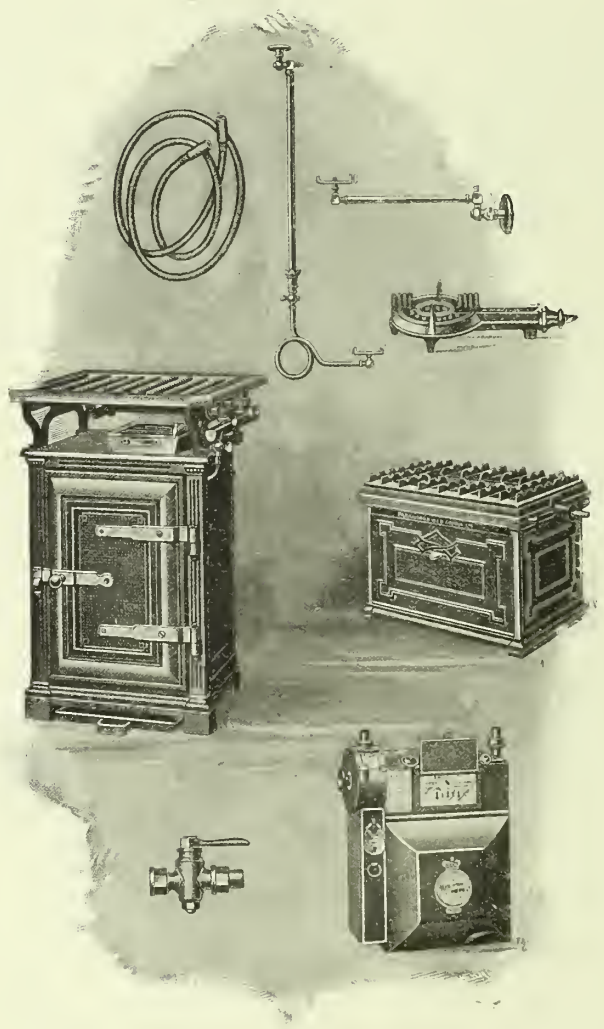

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Bell Barn Road, BIRMINGHAM.

An application made to the Local Government Board by the Calne Corporation, for authority to borrow £2500 for the provision of filter-beds, was not opposed at an inquiry held on behalf of the Board last Thursday.

At a recent meeting of the Gas Committee of the Mansfield Town Council, a report was presented on the inspection of a sulphate plant at Kingston-on-Thames; and the Committee strongly recommended the Council to have similar plant erected at Mansfield, and to have the necessary plans and an estimate of the cost prepared. This was agreed to.

At the last meeting of the Bideford Board of Guardians, a letter was read from the Local Government Board on the subject of a surcharge made by the District Auditor of £35 5s. 3d. in respect of sums paid to the Urban District Council for the supply of water to the Workhouse. The Board discharged the surcharge, and suggested that, in view of the case under appeal of the Chester Guardians and the Chester Water Company, the Board and the Council should enter into an agreement for the supply of water until the appeal has been heard. On the suggestion of the Clerk, the matter was referred to a Committee.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.
ACCOUNTANT AND CASHIER. Applications by Aug. 26. No. 4818.
SERVICE AND MAINLAYER. No. 4815.
SLOT COLLECTOR. Ilford Gas Company.
WORKING MANAGER. No. 4816.

Situations Wanted.
IN GAS OFFICE (HOME OR ABROAD). No. 4820.
MANAGER OR FOREMAN. No. 4819.
REPRESENTATIVE (GAS AND WATER). No. 4813.

Partnerships and Management.
GAS ENGINEER'S BUSINESS. No. 4817.
GAS LIGHTING. No. 4814.

As Representative of Gas and Water Firm.
No. 4821.

Company Meetings.
BRIGHTON AND HOVE GAS COMPANY. London Office. Sept. 13, Two o'clock.
THE CRAYS GAS COMPANY. St. Mary Cray. Aug. 28, 6.30 o'clock.

Plant (Second-Hand), &c., for Sale.
ACETYLENE GAS PLANT. Burgess and Son, Leicester.
STATION METER AND EXHAUSTER. Penrith Gas Works.

Plant, &c, Wanted.
SULPHATE PLANT. Goold, Hop Exchange.

Stocks and Shares.
BOGNOR GASLIGHT AND COKE COMPANY. Aug. 28.

TENDERS FOR

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BRADFORD GAS DEPARTMENT. Tenders by Sept. 12.

Coal and Cannel.
RAMSGATE CORPORATION. Tenders by Sept. 2.
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Coke.
RAMSGATE CORPORATION. Tenders by Sept. 2.

General Stores, Oxide Wiskets, Shovels, Oils, Glass, &c.
BRADFORD GAS DEPARTMENT. Tenders by Sept. 12.

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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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E. Shaul,
Manager.
Gas-Works, Penrith,
Aug. 17, 1907.

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THE Gas Committee of the Bradford Corporation are prepared to receive TENDERS for the Supply of the following STORES required in their several Departments during a period of One Year ending Sept. 30, 1908:—

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Oxide Wiskets, 25 dozen.
Cotton Waste, 60 cwt.
Best Engine Oil, 1500 gallons.
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Cylinder Oil, 1000 gallons.
Tarred Gaskin, 90 cwt.
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Weed Brooms, 72 dozen.
Best Lime, 120 tons.
Copper Lamps, 500.
Lamp Irons, 300.
Sheet Glass for Street Lamps, 21 oz., 9000 sq. feet.
Opal Glass for Street Lamps, 21 oz., 3500 sq. feet.

Forms of Tender, with any further Information required, may be had on Application to Mr. Chas. Wood, Gas Engineer, Town Hall, and samples may be seen at Mill Street Gas-Works.
The Contracts will be let subject to the Fair Contracts Clauses of the Corporation, which may be seen at the Town Clerk's Office, and which the accepted Contractors will be required to sign.
Tenders, endorsed "Tender for Stores," to be sent to me not later than Thursday, Sept. 12.
The lowest or any Tender will not necessarily be accepted.

Frederick Stevens,
Town Clerk.

Town Hall, Bradford,
Aug. 17, 1907.

RAMSGATE CORPORATION.
(Gas and Water Department.)

THE Gas and Water Committee invite alternative TENDERS for 12,000 and 24,000 Tons (Six and Twelve Months Supply respectively) of Best Quality soft caking and gas producing Screened DURHAM or other COAL, delivered free into carts on the Quay at Ramsgate Harbour, or free into the Stores at the Gas-Works. Deliveries in either case to be in equal monthly quantities as from the 1st of February, 1908. A distinct price to be named for each quantity.
Tenders to be sent in not later than Noon on Monday, Sept. 2, 1907, addressed to the Chairman of the Gas and Water Committee, Boundary Road, Ramsgate, endorsed "Coals."
The Committee do not bind themselves to accept the lowest or any Tender.
Full Particulars and Form of Tender on Application to the undersigned.

Wm. Thomson,
Engineer and Manager.

Gas and Water Offices,
Ramsgate, August, 1907.

RAMSGATE CORPORATION.
(Gas and Water Department.)

THE Committee invite Tenders for the Purchase of the whole of their Surplus COKE, estimated at from 1500 to 2500 Tons, or for quantities of not less than 200 Tons per Annum, from the 1st of October, 1907, to the 30th of September, 1908, delivered free on rail or barge, Ramsgate, or free into carts at the Gas-Works, Ramsgate—the Purchaser in any case to pay dues.
Further Particulars, together with Conditions and Form of Tender, may be obtained from the undersigned.
Tenders to be sent in not later than Noon on Monday, Sept. 2, 1907, addressed to the Chairman of the Gas and Water Committee, Boundary Road, Ramsgate, endorsed "Tender for Coke."
The Committee do not bind themselves to accept the highest or any Tender.

Wm. Thomson,
Engineer and Manager.

Gas and Water Offices,
Ramsgate, August, 1907.

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For Forms of Tender and Further Particulars apply to Mr. Alfred H. Brookman, Engineer and Manager, Gas-Works, Tenby.
Aug. 15, 1907.

THE CRAYS GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Stockholders of the above Company will be held at the Library, St. Mary Cray, on Wednesday, the 28th day of August, 1907, at 6.30 o'clock in the evening, to receive and adopt the Directors' Report and Accounts for the Half Year ended 30th June, 1907; to declare a Dividend; and for General Business.
The TRANSFER BOOKS WILL BE CLOSED from the 14th day of August next until after the said meeting.

W. B. Mimmack,
Secretary.

The Gas-Works, St. Mary Cray,
Aug. 6, 1907.

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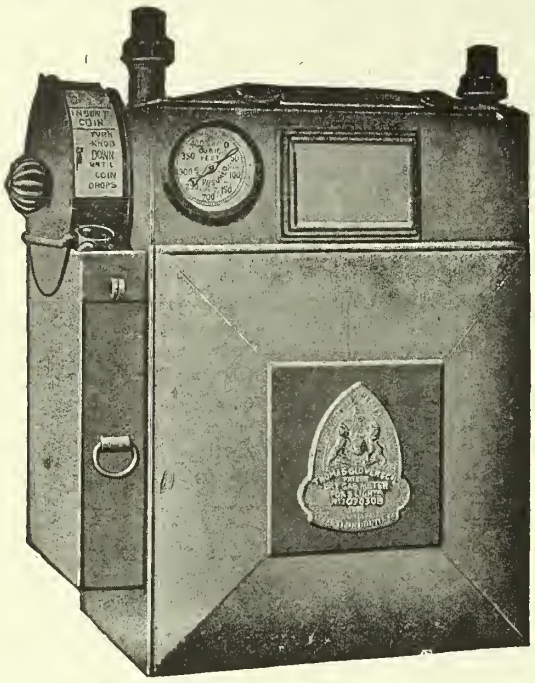

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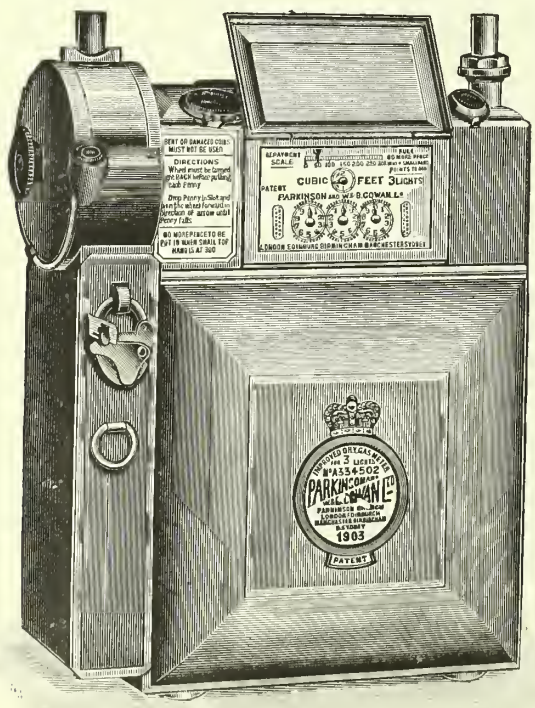

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. XCIX., No. 2311.—TUESDAY, AUGUST 27, 1907.

EDITORIAL NOTES—GAS, &c.

The Session's Gas Affairs.

THE prorogation of Parliament is fully expected to take place to-morrow. To the labours of Parliament the gas industry has not, during the session, contributed heavily. Possibly the attitude of the present dominant party of the House of Commons towards private enterprise, and the ultra-socialistic tendencies of a section whose behests are treated with servile respect, and whose actions and inflammatory words, however much opposed to law and order, go unreproved, have had some weight in the considerations which have induced Gas Companies to defer further appearance at Westminster. Suspensory clauses and other tokens of municipal patronage by the heterogeneous party in power are not calculated to give confidence that private measures will receive judicial handling. But the worst fears formed during the first session of the new Parliament have been mitigated during the second, by the menaced violent trampling down of private interests in pursuance of a policy having been checked before it could develop to actuality, and not only by the House of Lords but by the ratepayers. The Upper House stands for protection in these times, as we have witnessed in the case of the Bill of the Hull Corporation for despoiling the East Hull Gas Company of their property. And the ratepayers have proved their position and title to checkmate the tender regard of the followers of the Government for, and the submissiveness of the latter to, municipalization, in the case of the Merthyr Tydfil gas purchase proposal, and by the decisive vote in London that sounded the death-knell of the ambition of the Progressives to take under their capacious wing the electricity supply of the Metropolis and of territory a distance beyond. The only way the Government can now endeavour to help the Progressives is by the promotion of a Government measure for the purpose (it is suggested that gas and all other public services might be embodied in one); but if this were done, the Government would provoke such an outcry from the overburdened Metropolitan ratepayers, that we venture to think, strong as the Government are in the numbers of their following, they would hesitate to pursue the matter to the extreme end. The Premier has promised to do something before the end of the life of his Government, on the vague condition that there is unity. But he has delayed action by not promising anything for the session of 1908. When, if ever, the time arrives, the House of Lords and the ratepayers of London will not be found wanting.

Meantime, with the exception of the farcical decision of the Police and Sanitary Committee on the gas section of the Hull Corporation Bill, it must in fairness be said that, in the small amount of work the Select Committees were called upon to perform in connection with gas measures during the session, there has not been anything to complain about; and, as a matter of fact, their work has contained several commendable features—one particularly noteworthy being the refusal of the Police and Sanitary Committee to allow the Hull Corporation, by their private measure, to transgress the long-established principle, under the Lands Clauses Acts, of an allowance for compulsory purchase. This decision and one by another Committee, passing the Bill of the Worthing Gas Company for acquiring a site for new works at Goring, raised the question in the House as to the expediency of the House interfering with the judgments of Select Committees, in view of the mischievous effect it would have in debilitating responsibility and authority. In neither case would the House interfere; and the subtlety of the Hull Corporation in playing upon the anti-private-interest string availed them nothing in trying to create a precedent in a Private Bill for no allowance for compulsory purchase. The joy of their success in the Commons, however, in getting their purchase powers passed, was short-lived; for a few weeks later a Select Committee of the House of Lords found that the Corporation case for purchase was, as had been manifest throughout to all disinterested observers, so deficient in substance that it was incapable of standing to meet the case of the Company, and so they suffered it to collapse. It was a most undignified ending; but we hope a wholesome lesson has been administered by it to grabbing authorities. As a consequence, we are still in the position of having no precedent of a measure for the compulsory purchase of a statutory gas undertaking that has been contested through both Houses, excepting the one of Pontefract in 1906, in which the Chairman of the Committee fairly expressed the position when he said there was not in that case a clear line, but it was felt by the members of the Committee that there had been want of enterprise on the part of the Company. However, whatever the Commons are prepared to do, the House of Lords have declared they will not have such forced sales of statutory concerns unless there is plain proof of lethargy and of unfaithfulness to the trust reposed in the companies by Parliament. This Hull Purchase Bill alone has made the expiring session notable for gas supply; but the efficacious value of suspensory clauses in supporting the cause of gas-works purchase must have declined considerably in the eyes of municipal authorities, since the ratepayers of Merthyr resented the forwardness of their local authority, and the House of Lords ignominiously rejected the Hull proposals.

Altogether, there were not more than twenty measures dealing in any way with gas supply before Parliament this session; and but a small proportion were discussed before Select Committees. In nearly all instances, at the start of the session, petitions were lodged against the Bills; but in most cases opposition was withdrawn on further investigation into the provisions, or on agreement. The Removal of Sulphur Restrictions Bill was accepted as inevitable and as above attack by the local authorities concerned. Next to the Hull Bill, the Worthing Gas Company's Bill claimed a liberal amount of interest, owing to the strenuous and successful defence the Company made of their choice of a site for new works, against the enraged attacks of interested landowners at Goring, who left no stone unturned in their effort to do mischief to the public interests, in order that their individual interests should not suffer the harm that only exaggerated notions had created. The Annfield Plain Bill also got through, though subjected to a vigorous opposition. Mention of this measure reminds us that the Lord Chairman would not allow the promoters, nor those of the Llandrindod Wells Gas Bill, the little latitude enjoyed by the Metropolitan Companies, and more recently by the South Suburban Company, of a ½-candle margin below the standard illuminating power before becoming liable to a penalty. Illuminating power and testing have now got into a definite channel, in which channel the gas industry can for the time being afford to stop. Fourteen candles, though a few companies have managed to secure sanction to 13 candles, is the common illuminating power standard present; and the Metropolitan No. 2 burner and the 10-candle pentane lamp are the approved standards for testing. The new testing conditions have withstood the assaults of the few, made with narrow front and purpose, and without success. Had they been successful—there was no anticipation they would ever be, except possibly in their own minds—their work would have had the effect of restricting the industry's opportunities, for the widening of which time and money have been expended lavishly. The Board of Trade have declined to interfere with a fair and acceptable standard of testing the various qualities of gas commonly supplied; and now those who are working under anything but the new method are well behind the times. It has been occasionally found that in the drafting of Bills a little mixture of the old and new provisions affecting testing are inserted—through, we suspect, some misapprehension. Such a case occurred in the Twyford Order this session, and was referred to in

the editorial columns on Jan. 15. In the confirmed Order, the superfluous testing conditions appearing in the original have given place to the model form of clause. In the Mitcham and Wimbledon Bill, the South Suburban clause has been incorporated for testing for calorific power and by flat-flame burners for information only, and distinct from the penalty test with the Metropolitan No. 2 burner. We cannot see any possible value in multiplying these tests, and imposing more labour on gas examiners. There may be an idea lurking somewhere or other that the day will come when the information thus being gathered under different conditions may be useful in getting imposed a double test, or in deposing the illuminating power test for a calorific power one. Touching this testing question, the King's Norton and Northfield District Council were unsuccessful in inducing Parliament to destroy a parliamentary bargain whereby Birmingham supply gas in their area having a standard illuminating power of 15 candles. The Council asked for a testing-station of their own at a place not exceeding five miles distant from Birmingham. What that would have meant for the Birmingham Gas Department, in the way of increasing the cost of production through enrichment, can be imagined, if not readily estimated.

The above are perhaps the principal features of the gas measures of the session; but we know that between Draft Bills and Royal Assented measures many changes in detail have been effected. Notice of these, however, can wait until we have before us prints of the Acts, which can be brought into comparison with the original Bills.

Capital Indebtedness and the Consumer.

Before the beginning of the recent controversy in our "Correspondence" columns respecting the relative capital indebtedness per unit of output of Local Authorities and Gas Companies, Mr. Norton H. Humphrys, it now appears, had been incited by a sentence in the Presidential Address of Mr. Charles Hunt to the Institution of Gas Engineers to make a somewhat detailed study of the matter. The moving sentence was: "It must be apparent to all that, in their "treatment of capital charges, the local authorities have "been wise in their generation, and that their position in "years to come is likely to be a much stronger one than "that of the companies." If we may judge of the future by the commercial test provided by the past and the present, the process of attaining the "much stronger position" is unkindly slow, notwithstanding the advantageous situation of the major part of the gas-supplying local authorities. After reading carefully the account of Mr. Humphrys' investigation into the subject, the conclusion must be drawn that condition does not permit of any equal comparison being made, and therefore the greater the unfairness of presenting figures besmirching the capital management of the companies as a whole. It would be *ultra vires* for the companies to attempt to whittle down capital expenditure per unit of output in the manner that the local authorities, working entirely on borrowed money, are statutorily compelled to adopt; the process of reduction in the case of companies being of a much slower order. And, as a matter of fact, the method of redeeming capital by a compulsory sinking fund could not be applied to numerous undertakings in residential districts without doing immense injury to the consumers. The smaller municipal electricity undertakings have proved this not only by the hardship imposed on the ratepayers and by a continual struggle for life and solvency, but by the production of offences against legitimate finance, with the object of presenting a brighter aspect. "There "are more things in heaven and earth, Horatio, than are "dreamt of in your philosophy," or taken into account in the basis of your warnings.

From the primary capital condition existing throughout geographical and internal circumstance, gas companies, regarded as a body, are placed in a position totally different from that of the local authorities. As Mr. Humphrys shows, the consumers of the past and present generation in the case of gas companies are in no wise worse off, but rather better off than they would have been under the conditions of municipal administration. There is no reason why, given the excellent districts possessed by the majority of municipalities, company administration—relieved of the necessity of providing sinking funds and contributions to the rates demanded by grasping local legislators (and which contributions have shown no signs of diminishing since local government has incorporated strong-lunged demagogues of faction)—should not have done much better than the municipalities for the consumers in those districts. As Mr. Humphrys says, the position of the major part of the companies is in no sense a reproach to them. Their service has been and is excellent; and the consumers have nothing to complain about, as they have under municipal management by being the victims of indirect taxation, which can only be avoided by adopting means of lighting and of heating that are not under municipal management. It is admitted that all that is done towards reducing capital expenditure to-day should be to the advantage of the gas consumer of to-morrow. But, in the case of municipal administration, let the capital be reduced to its narrowest possible limits by a full respect for the sinking fund, and there are those sitting in the seats of the local mighty who will see to it that the gas consumer is not the greatest beneficiary. For the consumer, the steady easing-down of capital per unit of output on the part of the companies will possibly work a better result.

Gas Cooking and Heating Business—Workmen's Compensation.

The Directors of the Liverpool Gaslight Company, through their Chairman, Mr. H. Wade Deacon, continued the tale of prosperity of the concern at the meeting of the proprietors last Tuesday. The consumption of gas during the year increased by 2¼ per cent., in spite of the keen competition for private business of the municipal electricity undertaking; and the receipts from sales of gas increased by £12,835. Residuals, too, yielded their contribution to the balancing of higher expenditure, with £8000 additional for coke, and £4000 additional for tar, against which had to be set only £670 decrease on the income from ammoniacal liquor. The outlay on coal, through greater consumption and heavier price, was higher during the year; and the Directors, having now made their contracts for coal for the ensuing year, have knowledge of an extra expenditure of £30,000 (which is equal to 2d. per 1000 cubic feet of gas produced) under this head for the current twelve months. This brings us to a most important point in the meeting, which was the announcement that—notwithstanding this known great increase in expenditure, and the fact that only £6000 is carried forward after meeting interest and dividend—for the Company's high illuminating power gas the price is not to be altered, and this 2s. 6d. is the lowest price at which gas has ever been distributed for ordinary purposes in Liverpool. It is frequently charged against gas companies that they have no conscience for anything but their own interests; but here is a Company—an illustration of many others—paying barely 4½ and 4¼ per cent. at present market prices of their "A" and "B" stocks, who, though the struggle will be a tight one, are going to take the risk for the present of not reinforcing their finances by an increase in the price of gas. It is a wise policy, up to a point; and the Directors of the Company may be relied upon to distinguish when that point has been reached. We have no expectation, consequent upon this determination, that anything will be heard from the consumers as to the Company having been "fleecing" them aforetimes. On the contrary, one of the leading local papers, in an editorial article, prominently recognizes that the Directors will have to strain every nerve to keep the price down; and there is a note of gratification over their decision running all through the article.

There was a time when, on a considerable increase of the cost of coal, gas consumers were hit much worse than they are to-day; for whereas the dearer gas was being consumed at a greater rate—probably 12 to 15 cubic feet an hour in an ordinary living room—a superior illumination can now be obtained by consuming 3½ to 4 cubic feet an hour in an incandescent burner. Accompanying this fact, consumers should bear in mind, in these times of high-priced solid fuel, the considerations of saving in labour, convenience, and economy of gas, where the price is reasonably low, in cooking and heating through the facility of immediate lighting and extinguishing. There are no (what shall we call them?) "stand-by" charges and losses as in the case of a fire fed by solid fuel. This is a point of which sight is frequently lost. The managements of gas undertakings, prompted by their commercial enthusiasm, will look to their future interests by making the best possible use in the present of the high prices of solid fuel. We notice, in a special article on dearer coal

in the "Daily Telegraph," that one dealer is predicting that, in the coming winter, the price of household coal will return to the high level of 1900, when certain qualities touched 35s. per ton. But another retailer only anticipates a further rise of 1s. Anyway, household coal prices are quite high enough now to make the user lend a readier ear to representations that advantage him as well as the local gas undertaking. The electrical industry is not oblivious to the opportunity. They are lamenting the prospect of reduced consumption through the new high-efficiency lamps; and, in addition to the plans for reviving the campaign for the capture of prepayment consumers, the advice is given that now is a favourable opportunity for the "advantages" of cooking and heating by electricity—of which advantages economy is not one—to be sedulously propagated.

A matter that is agitating the administrations of gas undertakings as large employers of labour is the expansion of the risk under the Compensation Act which came into operation on July 1, and the extraordinary views of the insurance offices. The Directors of the Liverpool Gas Company have, like several other important concerns, after carefully considering the whole bearings of the question, decided that the Company shall take up the risk themselves. To prepare against it, they have set aside £1000 to form the nucleus of a fund. This is a big percentage on the Company's wages bill—more than the South Metropolitan Company, Sheffield, Edinburgh, and other administrations consider necessary. It is prudent to have a fund in hand, and a substantial one as early as convenient; and contributions can at any time be lessened when it is considered that the fund is at a point sufficient to cover any possible or serious contingency. With the decrease in carbonizing wages brought about by modern plant, upon which the Company have been spending largely out of revenue, the provision for compensation will not be a burdensome matter. But what large concerns can do in this matter of provision and self-protection under the Act cannot be as easily undertaken by concerns of the smaller magnitude, employing considerably less labour.

The Need of the Illuminating Engineer.

In an article on "Illumination" in the Engineering Supplement to "The Times" last Wednesday, Mr. Leon Gaster deals once more with a subject with which he has identified himself—viz., the need of men who are willing to devote themselves to the systematic application of the scientific principles of artificial illumination, or, in other words, "illuminating engineers." He points out that good illumination involves three essential points—the right quantity and the right quality of light, and the right use of it. For a proper understanding of these three prime conditions one has to be specially trained. He considers that in present practice illumination is left too much to mere chance, it being nobody's business to look after it. Once the installation is finished, the work and interest of the contractor cease; and the use—or rather the abuse—of the light is left to the inexperienced consumer, without possessing any knowledge of how to use it in the most economical manner. Mr. Gaster says the important *rôle* this new specialist will have to play in the near future may be better understood if it is mentioned that the expenditure for lighting in this country is estimated to exceed £36,000,000 per annum. To make a conservative estimate, about 10 per cent. could, in his opinion, be easily saved by properly looking into this matter; so that £3,600,000 could be turned to better advantage, and more satisfactory illumination be obtained.

Explosions in Electric Light Culverts.

The question of liability for explosions on occasions when an escape of gas is fired by another escape in the shape of a fused electric wire, is a matter upon which there has been endless discussion without any apparent result. An interesting explanation of these explosions has been given by Dr. H. Bassett in a paper read before the Liverpool Section of the Society of Chemical Industry, some extracts from which will be found in another column. The author directed attention to a case in which metallic potassium and sodium were produced by the escape of electricity from a subterraneau cable of which the insulation had become defective. The leakage occurred at a point where the negative cable had been joined; and the electrolysis of the surrounding water, containing potassium and sodium salt, had resulted in the production of a liquid alloy of the two metals, either of which will burst into flame if brought into contact with water. As during the electrolytic process considerable quantities of hydrogen must have been formed, all the materials for an explosion were present. Dr. Bassett expressed the opinion that many of the explosions in connection with electric light mains which are attributed to coal gas are very possibly really due to "hydrogen formed by electrolysis." This opinion, as Dr. Bassett acknowledged, is only a reiteration of a suggestion first put forward by Mr. G. F. L. Foulger nearly twelve years ago, on the occasion of the inquiry by the Board of Trade into the explosion which occurred in the conduit of an electric light main in the Euston Road. The facts cited by Dr. Bassett make it all the more necessary that the causes of these explosions should be thoroughly investigated.

"Gas Used on Works."

This is an item in the statement of gas made, sold, &c., that covers a number of legitimate uses on a works, and occasionally it has been known to carry more than its fair burden. In many works now, electricity generated by gas-engines is used for driving plant. This is the case at the Bournemouth gas-works; and it is not considered fair by the Directors and officials of the Company that the item "Gas Used on Works, &c.," should bear this additional use without proper recognition and charge. Therefore, in the statement of gas made, sold, &c., the common phrase has been altered to "Quantity used on works for Light and Power." In the revenue account, under "Manufacture of Gas," there is a charge "Sundries at Works, including Power Gas," £999; and on the opposite side of the account under sale of gas is the credit "Power Gas on Works, £409." This is a practice that Mr. William Cash, the Secretary of the Company, hopes will be followed by other gas companies wherever gas power for works' purposes is largely used.

Hot-Water Circulating Systems.

The Gaslight and Coke Company have taken up the gas hot-water circulators with much energy and success; and in many other quarters the system has attracted attention, and has been the subject of comment at meetings of shareholders. Mr. G. Crispe Whiteley, the Chairman of the Bournemouth Gas and Water Company, is a great believer in the future of this system of water heating and circulation throughout a house. The convenience and the comfort afforded are so great that the circulators are bound to advertise and commend themselves; but they want a little pushing, just as the gas-cooker did at the start. In Bournemouth there are sixty hot-water circulating-boilers using gas now installed; and the Chairman asks for reasons why, if 60, there should not be 600, and if 600 why not 6000. The only answer we dare to suggest to him is that there is the cost of the installation and the derangement of a dwelling while the fitting up is proceeding. It is not quite such a simple matter as the installation of a gas-cooker. But the Bournemouth Company have made a good record in the matter of getting out cookers. They have 18,500 householders in their district; and there are 14,000 cooking-stoves fixed. In face of this, we look for a large increase in their area of gas-heated water-boilers; but expectations cannot rise quite to the heights suggested by the Chairman.

The Business Side of Engineering.

In the course of an article on this subject in the Engineering Supplement to "The Times" last Wednesday, Professor Ayrton directed attention to the fact that the collegiate teaching of engineering in this country usually excludes one of its most important branches—the business side, as distinct from the purely scientific and technical sides. He attributed this partly to a feeling that the application of the principles of business can only be learnt in the office, and partly to an impression—the correctness of which he readily admitted—that a shrewd business man, like a poet, is born, not made. He went on to point out that while the practice of our forefathers was to make an engineer of a lad by putting him straight into works on leaving school, we now send him to a technical school or college, to learn the application of mathematics and science to engineering, under teachers of these subjects. "Why not, then," he asked, "teach the principles of business in these colleges, instead of leaving the budding engineer to stumble on them by trial and error—chiefly error—when he is actually

engaged by some firm of engineers?" In this respect, as in some others, our American cousins are in advance of us, inasmuch as in certain of the engineering colleges in the United States great attention is given to the business side of engineering. For example, as Professor Ayrton mentioned, it is the "Professor of Business Engineering" who is the President; and he, as our readers are aware, is Dr. A. C. Humphreys, of Messrs. Humphreys and Glasgow. In the course of a conversation the President had with Professor Ayrton, he told him that he was chosen by the Trustees to preside over the College "because he was a successful man of affairs;" and it appears that he divides his time fairly equally between the science and the practice of engineering. His mornings are devoted to his collegiate work, and his afternoons to the affairs of the important firm with which he has been for so long associated, whose plant, as our advertisement pages testify, is to be found all over the world. Probably a better example of the advantageous combination of engineering skill and business capacity could not have been selected to emphasize the writer's point. Doubtless the combination is rare; but, on the other hand, it may exist to a greater extent than is supposed, and only await development. Professor Ayrton is therefore deserving of thanks for his suggestive article.

Uniform Gas Prices at Vienna.

The authorities of the Vienna Municipal Gas-Works have recently decided, according to "Gastechniker," to abolish the differential rates they formerly charged for gas, in favour of a uniform selling price. Hitherto the charge for lighting gas has been 19 heller per cubic metre [at the current rate of exchange, 24 k. being equal to £1, equivalent to about 4s. 6d. per 1000 cubic feet], and that for heating and power 14 heller, or 3s. 4d. Now the rate is fixed at 17 heller or 4s. per 1000 feet for all purposes. In consequence of the change, it has been decided to abolish the discount formerly accorded to consumers who used more than 200,000 feet per annum for lighting purposes; but to give industrial consumers discounts ranging from 5 to 15 per cent. if their total consumption exceeds 350,000 feet. The institution of the fixed price also involves a reduction of about 6d. per 1000 feet in the price of gas when supplied through slot meters. It is believed that the change will cause a reduction in the bills payable by 80 per cent. of the consumers, will increase those payable by about 10 per cent., and will leave the remainder practically unaffected. Inasmuch as the 80 per cent. are largely made up of small traders and persons who work in their own homes, it is considered that the alteration will benefit the general public. The advantage to the gas uudertaking is, of course, obvious, as it reduces the number of meters at work, simplifies the connections that have to be made in fitting up new premises, and diminishes the amount of book-keeping requisite.

Scottish Junior Gas Association (Western District).— The "Transactions" of the Western District Section of the Scottish Junior Gas Association for the session 1906-7 have been issued in book form. The volume extends to 72 pages, and contains the papers read before the Association during the past winter, with the discussions upon them, reports of the visits paid to works, lists of the members, the accounts, and the photograph of the members taken at the fire-clay works of Messrs. James Dougall and Sons, Limited, Bonnybridge, on the occasion of the visit of the members in January. The annual report of the Council is also given, in which it is stated that the membership numbers 123, consisting of 110 ordinary and 13 honorary members; and also during the year the Council purchased fourteen books on gas manufacture, which they presented to the library of the Glasgow and West of Scotland Technical College. At the end of the third session, there was a balance in hand of over £23.

Assessment of Compensation under the Lands Clauses Act.— Questions of some complexity frequently arise as to what are proper matters for compensation in respect of land acquired compulsorily by statutory companies and public authorities under the Lands Clauses Act, 1845; and in a pamphlet by Mr. R. A. Gordon, M.A., LL.M., of the Inner Temple and the South-Eastern Circuit, the principles on which this right to compensation is based are discussed. The subject was chosen by the author for treatment when going up for the degree of LL.M. in the University of Cambridge. The matter is divided under two headings—(1) compensation where land is acquired compulsorily for the purpose of a public undertaking; and (2) compensation where no land is taken, but is injuriously affected by the construction of authorized works. Under this heading the author points out that the damage or loss must be the result of an act made lawful by the statutory powers of the promoters; and he cites the case of *Broadbent v. Imperial Gas Company*, which will be within the recollection of some of our readers, in support of the statement that if a statutory company extend their powers and cause damage to a proprietor's land, his redress is by action, and not under the Lands Clauses Acts. The pamphlet is being published by Messrs. Butterworth and Co., at the price of 1s. net.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 593.)

Though not uniformly good throughout, last week's doings on the Stock Exchange were an improvement on its predecessor, and certainly left the position better than they found it. It was a short week, too—the Exchange being closed for a holiday on Saturday; and this brought about something of an increase in the Friday realizations and their consequential lowering effect. But for this, the tone at the finish might probably have been better than it actually was. The opening was anything but good. Movements were shifty and irregular; but the prevailing tone was decidedly dull. One small failure did not help to infuse cheerfulness. Tuesday was a very flat day. There was some renewal of disquieting realization; and almost every market was depressed—South African being conspicuous in this respect. The gilt-edged division—one of the chief sufferers lately—was, however, inclined to look up. On Wednesday, a brighter state began to dawn. Influenced by the Wall Street tone, a recovery manifested itself; Consols and Home Rails being well to the front. This improvement was fortified on Thursday. Selling seemed to stop; the pendulum began to swing the other way; and buying was more the order of the day. The fact of the Bank Directors making no further advance in the rate was a relief to those who had been fearing another rise. Consols rose $\frac{1}{4}$. Business was very quiet on Friday; but the general firmness was slightly impaired by some closing of accounts, which took a little off the advance that Consols and Rails had made the day before. In the Money Market, there was a fair demand for loans at pretty easy rates; and discount, which had opened firm, was much easier before the close. Business in the Gas Market was not so bad for the time of year; but the great bulk of it was in the chief issue. The tendency was quite steady; prices on the London market being unchanged. Gaslight and Coke ordinary was rather active, and changed hands at steady figures ranging from $92\frac{3}{4}$ to $93\frac{3}{4}$. In the secured issues, nothing was touched but the preference, which marked 104 and $104\frac{1}{2}$. South Metropolitan was very quiet, with two bargains at $119\frac{3}{4}$ and $118\frac{1}{2}$. The debenture was done at $82\frac{1}{2}$. Commercials had only one deal in the 4 per cent., at $106\frac{1}{2}$. The Suburban and Provincial group were quite quiet. Bournemouth "B" was done at 17, Brentford new at 187, and West Ham debenture at 100. On the local Exchange, what is there called an "odd lot" of Newcastle debenture was let go at 90, which put the price down. In the Continental Companies, Imperial marked $173\frac{1}{2}$ to $174\frac{1}{2}$, ditto debenture $91\frac{1}{2}$ and 92, Union 114, European fully-paid $22\frac{1}{2}$ and 23, ditto part-paid $17\frac{3}{4}$, and Malta $4\frac{1}{4}$. Among the undertakings of the remoter world, Melbourne 5 per cent. was done at $101\frac{1}{8}$, Oriental at $143\frac{1}{2}$ and 144, and Primitiva preference at $5\frac{1}{8}$.

ELECTRIC LIGHTING MEMORANDA.

Coal and Costs—The Peak-Load—Reduction of the Average Horse-Power Connected at Bradford—Insurance and Accidents to Machinery—Ignoring One Party to a Contract.

The electrical papers have not taken much notice of the question of the increase in the price of coal, and of the influence it will have upon works' costs, upon the price of electricity, and upon the net profits of electricity undertakings. Coal is the heaviest element in works' costs; and therefore the increase in its cost will be a serious matter. At West Ham the coal bill has been heavier by £2580; and at Newport (Mon.), by some £1200. At Derby, just recently, the Chairman of the Corporation Electricity Committee stated that the department had had to pay considerably more for coal than they did last year; and this would entail an increased expenditure of about £1000 a year. We do not think Derby can afford to shed so much without having a deficit, as the "Electrical Times" tables show that the department only took credit for £134 of net profit in the year to March, 1906. The local authority of Sleaford have also been bewailing the additional expense that will fall upon their little struggling concern. But, speaking generally, the price of electricity for power and "heating" business has been cut very fine; so fine that the slightest wavering in expenses in cases produces loss. Most undertakings, too, can point to installations the intermittent and short-hour load of which invariably contributes, at the prices accepted, to loss and not to gain. We shall expect twelve months hence to see many additions to municipal electric accounts with deficits which will show how close in the matter of prices electricity undertakings have been cutting to get any business. While mentioning coal, attention may be drawn to a scheme in vogue at the Cheltenham electricity station, for rewarding the men for savings of coal. The night shift has been having a bonus of 2s. 6d. per cwt. saved for every 1000 units generated; and so satisfactorily has this worked that the bonus is to be increased to 5s.—the extra 2s. 6d. being equally divided between the day and night shifts. In the four weeks ending July 8, the saving in coal was valued at £11 17s. 2d.; and the men received by way of bonus on this £1 16s. 7d., which left a net saving of £10 0s. 7d. to the department. It is a very profitable way of encouraging greater interest among the men in their work, and of teaching them the value of economy.

Our friends of the "Electriciau" have had an editorial on the subject of the peak-load in electricity supply. The peak-load is always regarded as that which is the most costly to meet; and for the matter of that the lowermost depression in the load curve supply a decent second. Of course, it is a good thing to level down the peak as much as possible; but it must not be forgotten that, with any system of lighting, there must always be more or less of a peak, and that the peak in the case of a town electricity undertaking is a protuberance from the load that brings in more revenue than any other, and without which load the electricity undertaking would not be able to partially fill in its valleys with a miscellaneous business, a portiou of which is of a character in lightness and duration that does not pay, so the station engineers find out, at the prices at which it has been taken on. Our contemporary says that, though on most electricity supply networks, the peak-load does not assumc such an important position as it did some years ago when the remainder of the load was practically unimportant, it still takes up an unpleasantly prominent position on most load curves, and receives attention from time to time in the Technical Press as that part which is more or less undesirable. "It is looked upon as the part of the load which is the most easily obtained, and the part which is the least profitable. In a scnse this is so." But it must not be overlooked that this peak springs from the load that produces the greatest income; it is a sort of necessary evil, and so must be taken as part and parcel of the load, and not as something distinct. Another point in our contemporary's article is:

> The charge for a lighting load must always be heavier than that for a load which is maintained for longer hours. There must necessarily be a difference in price; the only objection to having such a properly proportioned price is that the consumer of light for short periods feels aggrieved that he should not get it at a very low rate. That there should be a difference in price at all is a point which our gas friends generally find difficult to grasp, simply because in the manufacture of gas a means of storage on a large scale is commercially possible, and the question of a peak-load does not come into account.

Our contemporary misjudges. We have no difficulty in graspiug the necessity for differential prices; they exist in the gas business as between on the one hand industrial uses and on the other lighting, heating, and cooking. But what we do not appreciate is why any day electricity consumers should be taken on whose business at fine prices it would be more profitable for an undertaking to be without, as was shown some time since by the "Electrician" in a series of articles dealing with power supply in London, and by papers at the last meeting of the Municipal Electrical Association, in which the speculative fixing of charges was condemned (*ante*, p. 218). Gas power consumers are taken on, but not at prices below the averagc cost of the gas per 1000 cubic feet; and there is in most cases, except for specially large business, uniformity of price for gas used for lighting, cookiug, and heating. But when we see such wide differences as (say) 0·60d. or 0·75d., for electricity power business, and 1d. for short time heating and power busiuess, in the valleys of the curve, aud 4½d., 5d., and 6d. for lighting business, the backbone of the undertaking, we cannot admit that the full extent of the obligation of the undertaking to the lighting consumer is being recognized. The railway companies have lately been grumbling about their revenues. Perhaps if they took a leaf out of the book of laws governing electricity undertaking charges, and increased their fares at the times of the peak-loads of suburban traffic—say, from 8 to 10 a.m., and 4 to 7 p.m.—and reduced the fares considerably in the intervening valleys, they might —— well, we will not say what they might or might not do, but there would be an awful row.

The electricity power business does not appear to be extending towards the larger units; and long-hour users of power do not give any evidence of their fascination by this system of driving, from the point of view of economy. The Electrical Engineer of Liverpool some time since pointed this out; and now a report is to hand from Mr. T. Roles, the Electrical Engineer to the Bradford Corporation, telling us much the same thing. Iu that city, the output of electricity for power purposes has remained practically stationary since 1904; and generally the sale of electricity is not increasing to anything like the extent which could be expected or desired. A fresh scale of charges for power came into operation in the early part of 1904; and we may suppose that the revision was made for very good reasons. But what has been the result? While the average horse power of the motors connected gradually rose, up to and including March 31, 1904, from 3·5 to 5·1, since then it has gradually dropped to 4·8. This is a small average power; and it is conclusive evidence that in Bradford the higher horse-power motors are not growing in favour, and that only small ones are now being coupled up. Assuming that this is all due to the price charged, what Mr. Roles says shows that the price will have to come down considerably below 1⅛d. per unit to have any persuasive power, because, even at that price, "the larger consumers" have been giving up "taking a supply from the mains and installing their own generating plants or adopting gas-engines, operated, for the most part, by suction gas;" and they would not have been doing this, and taking upon themselves the additional labour, anxiety, and responsibility attaching to a plant of their own, if they thought there was any chance of the Corporation Department being in a position to supply them at an equally low rate. Short-hour consumers are being attracted and retained; but the long-hour ones are sliding off. Mr. Roles is therefore of opinion that the prices must, in the interests of the undertaking, uow be revised, in order that he may have something to offer the long-hour users and large consumers, and at the same time place the less desirable users on a paying basis.

Affecting the question of power supply is that of the reliability of electrical machinery. The report for 1906 of the Chief Engineer of the British Engine, Boiler, and Electrical Insurance Company, Limited (Mr. Michael Longridge, M.A., M.Inst.C.E.), is now before us; and in it we find that there has been another large increase in the business of the Company's electrical department, which goes to prove that the insurance and inspection of this class of machinery by independent men is useful, and is appreciated. As compared with 1905, the number of dynamos and motors insured increased by 15 per cent., and the breakdowns "increased" in a somewhat lower ratio, both in number and cost. The Company are at a loss to know whether thanks are due to the makers of the machines insured for supplying better designs and workmanship, to the owners for exercising greater care, or to the Company's own inspectors; but probably all have contributed. Besides dynamos and motors, a very large number of motor-starting switches have been insured; but with them breakdowns have increased far more rapidly than the insurances, and the cost of repairs in a still greater ratio. The rate of breakdowns during the year among dyuamos was 1 in 16, and among motors 1 in 8·2. The rate among contiuuous current machines, both dynamos and motors, was twice as high as among alternators; but the cost of repair per breakdown, was only about one-half. This is no doubt due to the relatively large size of the alternators. The proportions in which the various parts of the machines are thought to have caused or initiated breakdowns are tabulated. Taking the parts which it is believed failed first, the percentages to breakdowns are as follows: Armatures and rotors: Dynamos, 50 per cent.; motors, 44 per cent. Magnet coils and stators: Dynamos, 11 per cent.; motors, 14 per cent. Commutators and brush gear: Dynamos, 20 per cent.; motors, 28 per cent. Miscellaneous: Dynamos, 19 per cent.; motors, 14 per cent. Under the head of starting switches aud controllers, the percentages are: Resistance coils, 48 per cent.; contacts and switch arms, 10 per ceut.; automatic apparatus, 17 per cent.; miscellaneous, 25 per cent. The causes of the breakdowns were probably as follows:

	Dynamos. Per Cent.	Motors. Per Cent.	Starters. Per Cent.
Accidental	15	9	22
Dirt and neglect	14	19	11
Age and deterioration	21	25	23
Bad workmanship and design	23	18	9
Overloading	0	2	7
Unascertained	27	27	28

The peculiar question (referred to a fortnight siuce) that has arisen over the transfer of certain portions of the borough of Hampstead to the area of the Marylebone Borough Council, aud consequently of the electricity consumers through the operation of the London Electric Lighting Areas Act, has again been before His Honour Judge Selfe. The clectric lighting consumers transferred, it will be within recollection, had had no notification of the change, and when their accounts came in they discovered that, *nolens volens*, they were being charged double the 4d. per unit they had been paying the Hampstead Council. The question was raiscd in the "Memoranda" whether, although the Electric Lighting Areas Act authorized the transfer of the areas, it also continued supply contracts made at one price with the Hampstead Couucil and vested them at a higher rate in the Marylebone Council without any proper intimation being granted to one of the parties to the contract. His Honour Judge Selfe is sympathetic towards the consumers, although his opinion is that the Act in question not only gave the Marylebone Borough Council the same powers over the residents in the transferred districts as over the residents in the other parts of Marylebone, but that it also relieved the Hampstead Borough Council of its duties and obligatious. Admittcd; but it does appear to us that it is stretching the authority given by the Act to say that the relieving of the Hampstead Borough Council of its duties and obligations also empowered the Marylebone authority to take up a contract with a private individual and put into it (as it were) an enhanced price without proper notice, so as to enable the consumer to acquiesce or otherwise. For instance, one of the defendants had a contract with Hampstead for ten years at 4d. per unit; but suddenly and without warning he was transferred to Marylebone, and his account has been rendered at 8d. It is all a question of the interpretation of the extent of the power given by an Act. Leave to appeal has been granted; and His Honour is also not unwilling to reconsider an application for a new hearing, if Counsel considers that the whole of the facts are not in his (Judge Selfe's) possession.

It has been decided by the Paris Municipal Council to perpetuate the memory of Professor Berthelot by re-naming the Place du Collége de France the Place Marcelin Berthelot.

The death is announced of Mr. Joseph Kincaid, senior partuer in the firm of Messrs. Kincaid, Waller, Manville, aud Dawson, civil engineers. Mr. Kincaid, who was upwards of 70 years of age and a bachelor, had enjoyed excellent health until a few days before his death, when illness prevented him joining friends in the country. He was a Director of the Primitiva Gas and Electric Lighting Company of Buenos Ayres, Limited.

PUBLIC LIGHTING OF THE CITY OF LONDON.

Abolition of the Flat-Flame Gas-Burner.

The report on the works executed by the Public Health Department of the Corporation of London during the year ending Dec. 31 last, prepared by the Engineer (Mr. Frank Sumner, M.Inst.C.E.), which has just been issued, contains particulars in regard to the public lighting. They open with the interesting statement that during the year "the system of lighting by means of incandescent gas-burners was completed, and the last public flat-flame lamp removed from the City streets." The number of gas-lamps (including experimental lamps) paid for by the Corporation at the end of the year was 2804—being a decrease of 35 during the twelve months, accounted for by the removal of a number of lamps in the side-streets adjacent to the thoroughfares lighted by high-pressure lamps, and also by lamps removed from certain courts. There were 2710 square and 90 circular lanterns and 2176 brackets in use; the hourly gas consumption of the ordinary burners ranging from 4·25 to 21·25 cubic feet, and of the high-pressure burners from 10 to 151 cubic feet. There were 66 back lamps and 26 special lamps in service last year. An additional 2000-candle power high-pressure lamp was put up in Lombard Street, at its junction with King William Street, in place of an electric arc lamp. The light from the new high-pressure gas-lamp at St. Martin's-le-Grand was found sufficient to permit of the electric arc lamp by the corner of this thoroughfare and Cheapside being removed; thereby effecting a saving of £26 per annum. The experimental lighting of certain main thoroughfares, authorized by the Court of Common Council on May 4, 1905, was continued during the year, and a small extension was carried out in Arthur Street East, Mounment Square, and Lower Thames Street, opposite Billingsgate Market. The numbers of these experimental lamps are 35 low-pressure, consuming 7 cubic feet, 38 high-pressure burning 10 cubic feet, 46 burning 20 cubic feet, from one burning 30 cubic feet. The low-pressure lamps are in Fleet Street, and the 20-feet high-pressure lamps are in Queen Street and Queen Victoria Street.

In October last, a statement was laid before the Streets Committee relating to the annual maintenance of lighting the various areas; showing the difference in the cost of lighting the thoroughfares by incandescent gas compared with the method then in vogue—viz., electric arcs supplemented by incandescent gas. The statement, which was given in the "Journal" for the 6th of November (p. 396), showed that the total estimated annual saving on the lighting bill as agreed by the Court of Common Council was £371, while the actual annual saving is £490—an increase of £119. This is accounted for mainly by the abolition of compressors (the lamps in Queen Victoria Street and Queen Street being connected direct to the Gas Company's high-pressure mains), the substitution of 600-candle power lamps on 11 rests for 900-candle lamps, and the rearrangement of the lamps and the extinguishing of 13 additional gas-lamps found to be unnecessary in the vicinity of the new lighting. The statement also gave the cost of carrying out the works; and it showed a reduction of £194 on the sum voted by the Court. This is accounted for by the saving in constructing and supplying a compressor-house and plant, and obviating the necessity for laying an independent high-pressure gas-main throughout the length of Queen Victoria Street. During the year five lamps of the new Scott-Snell type were fixed—one on the rest in Cheapside, and four in Cannon Street, Dowgate Hill, and Budge Row. In regard to them, Mr. Sumner says: "These lamps are of a self-intensifying character; and a lighting value of 600 candles is claimed for them, with a consumption of 15 cubic feet per hour, at an annual cost of £9 5s. per lamp per annum. The reliability of the automatic mechanism has not been sufficiently proved to warrant an extension of the use of this type of lamp at present."

The number of defective gas-lights observed and reported upon by the Inspector of Gas Lighting during the year was 1813; being 1654 ordinary and 159 high-pressure. The number observed by the police was 34 incandescent and 3 high-pressure lamps. The details of lighting defects in the ordinary incandescent lamps were: Feeble lights, 1298; lights went out, 52; not alight during night, 33—total, 1383. In addition, 271 defects in the lanterns and burners were reported to the Gas Company, and they were rectified. The readings of the meters attached to the public lamps in various parts of the City show that the full contract quantity of gas is given at these lamps; and Mr. Sumner is of opinion that the stipulated amount is furnished generally throughout the City, and that the regulators of the lamps are kept in proper condition. The public lamps were lighted whenever fog or unusual darkness occurred. This happened on eleven days during the past year, and entailed a cost of £180 1s. 6d.

On the subject of electric lighting, Mr. Sumner says the lighting of most of the main thoroughfares of the City by arc lamps was continued throughout the year. The number of lamps in operation at the close of the twelve months was 449; being a reduction of 16. The cost of each is £26 per annum. These lamps were lighted on five days when fog or unusual darkness occurred. The number of defective electric lamps observed during the year was 178; and the City of London Electric Light Company were fined for each failure. The Company withdrew their refusal to take down their arc lamps in Queen Victoria Street and Fleet Street, which had been lighted by incandescent gas-lamps, and the extinguishing of the arc lamps in their eastern district, which had been lighted by high-pressure gas, and proceeded with the extinguishing of the lights and the removal of the columns and brackets. In addition, five arc lamps were removed during the year in connection with a rearrangement of lighting. It was also decided to remove the arc lamp in Fore Street, near the entrance to Cripplegate Churchyard, and substitute gas-lamps for it.

THE LIGHTING AT THE DUBLIN EXHIBITION.

In our Institution number, a special article appeared on "Impressions at the Dublin Exhibition." Since then, there have been occasional references in the "Electrical Times" to the subject of the lighting of the exhibition; and the latest one scoffed at some published expressions of opinion by a deputation from the Devonport Corporation Gas Department. Mr. P. S. Sheardown, who, be it known, is "Consulting Electrical Engineer (hon.), Irish International Exhibition," has addressed the following letter on the subject to our electrical contemporary:

> Perhaps it may interest you to learn that the arrangement made for lighting the exhibition was that half the supply was to be from electricity and half from the Dublin Gas Company, who were large guarantors, and offered special terms. When the lighting scheme was discussed, it was decided that most of the main buildings should be lit by electricity, which left the gas people with a big show outside; and they have made the most of their opportunity.
>
> I think it is not realized by some people that no matter what the source of the light, if there is only enough of it, the resultant illuminations or glare will be brilliant.
>
> The outside area lit by gas at the Dublin Exhibition is 51,100 square yards. This space is covered with 192 1500-candle power gas-lamps. The outside area lit by electricity is 68,155 square yards. This is done very satisfactorily with 90 2000-candle power flame arc lamps. This works out: One 1500-candle power gas-lamp per 266 square yards illuminated; one 2000-candle power arc lamp per 757 square yards illuminated. But in the main avenue the congestion of gas-lamps is still greater.
>
> The Art Gallery is lit throughout by electricity; but a few pilot gas-lamps are installed for use at night, in order to make it unnecessary for the night-watchmen to carry oil-lamps into the building. Where possible, it is, of course, always safer to have a second string to one's bow, even if the second string is a pound of candles. But I cannot understand the gas people trying to make capital out of the position of understudy.
>
> If the Devonport people had looked a little closer into things, they could have discovered a gas-lamp right over the electric generating plant in the Machinery Hall, which is most useful when the electric light fails, which it does regularly at eleven p.m. (shutting-down time) every evening.

We do not think that experienced electric lighting engineers will feel grateful to Mr. Sheardown for his letter. Mr. Sheardown is Electrical Engineer to the Tramways Company, and might with advantage have left the discussion of this subject to his brother electricians more experienced in this branch of the profession. Their silence is justified by the demonstration at the exhibition. It may be left to the general public to form their own opinion as to whether the area of the exhibition affording location to flame-arc lamps is, as stated by Mr. Sheardown, satisfactorily lighted; also as to whether those flame arc lamps can possibly be anything like 2000-candle power compared with the 1500-candle power high-pressure incandescent gas-lamps. In our article, "Impressions at the Exhibition," published on June 25, it was stated—

> Taking up a position in one part of the grounds, we see the end high-pressure gas-lamp in front of the Palace of Industries. There are three flame-arc lamps close by. The high-pressure gas-lamp illustrates what is meant by "light diffusion;" the flame arcs, what is meant by "light concentration."

Mr. Sheardown, we have no doubt, is a constant visitor at the Exhibition; but he does not seem to have taken the opportunity of comparing *one* high-pressure incandescent gas-lamp with *several* flame arcs. He is also apparently oblivious of the fact that the centre of the principal building has only eight high-pressure lamps, and is surrounded by flame arcs. There is no necessity to comment again in these columns on the contrast. Mr. Sheardown states that "If the Devonport people had looked a little closer into things, they would have discovered a gas-lamp right over the electric generating plant in the Machinery Hall, which is most useful when the electric light fails, which it does regularly at eleven p.m. (shutting-down time) every evening." This is quite correct. But it is rather more serious, and not quite so amusing, when one considers that the electric light has irregularly failed before the regulated shutting-down time mentioned by Mr. Sheardown, causing considerable consternation; also that a fire is reported to have been discovered in the Concert Hall—a wooden building—caused by a defective wire, which fire, had it not been found out immediately after it started, would probably have burnt to the ground the whole of the Main Entrance, the Concert Hall, and Restaurant. Of course, as Mr. Sheardown is Honorary Consulting Electrical Engineer, one would expect him to be aware of these matters.

When the lighting of the Exhibition was first discussed, the greatest opposition was offered to any gas lighting being introduced—it being argued that the Insurance Companies would not insure the buildings if gas were used, and that it would not be in the interests of the Exhibition to have gas lighting in any portion

of it. Mr. Sheardown now overlooks the fact that one-half of the Machinery Hall is lit by gas, practically the whole of the Main Entrance, and the Morehampton Road Entrance, the Gas Pavilion, and the centre of the principal building. He should also be aware that the Gas Company are not responsible for the number of lamps in the main avenue. Evidently the gentleman who was consulted by the Exhibition authorities thought it necessary to erect these lamps, in order to equalize the lighting of this portion of the grounds with that lit by flame-arc lamps. If he has seen the lighting, it is probable that in the next scheme he carries out, where the two systems are combined, he will reverse the order of things. Wisdom is born of experience.

DR. BUEB ON VERTICAL RETORTS AND OVEN CARBONIZING CHAMBERS.

The following is an epitome of an article which Dr. J. Bueb, the deviser of the Dessau system of vertical retorts, has contributed to the "Journal für Gasbeleuchtung" on the relative merits of vertical retorts and large carbonizing chambers similar to those at the Munich Gas-Works, of which reports have been given in recent numbers of the "Journal" (*ante*, pp. 438, 501).

Two methods are now being tried in place of the old system of gas manufacture, with a view to simplifying and cheapening the production of coal gas. One is the introduction of the coke-oven into gas-works, and the other the use of vertical retort-settings. In coke-works, the gas produced is chiefly used for heating the ovens, and any surplus is generally applied to heating boilers or supplying gas-engines. No considerable progress has been made in applying coke-oven gas in Europe in place of coal gas, for the following reasons: Ordinary coke-oven gas is not so uniform nor so good in quality as coal gas, because the mode of working differs, and the ovens are less sound than gas-retorts, while the reliability of lighting would be in question if the supply of gas to towns depended on the coke-works. Modern gas-works require relatively few workmen, and in the event of strikes they could, at a pinch, be run by the officials, with perhaps help from troops. Thus a town would not be left in darkness through a conspiracy of the workmen. But the coke-ovens are subsidiary to the mines and blast-furnaces, and could not guarantee to deliver gas in the event of either of these being shut down for any considerable period owing to a strike.

The coke-works, therefore, not being a trustworthy source of gas, it has been proposed to erect instead coke-ovens on the gas-works, and to distribute the gas produced over and above that required for heating the ovens. This surplus gas would amount from a good coking coal at the outside to 30 per cent. of the gas made; and as it would be taken from the early stages of carbonization, it would be equal in illuminating and heating power to the earlier coal gas. But whereas in ordinary gas-retort working there are, per ton of coal carbonized, about 0·55 ton of coke available for sale, and about 10,750 cubic feet of gas made, with coke-ovens the same quantity of available gas would be attended by the production of 2·33 tons of coke. A gas-works, therefore, which depended on the surplus gas from coke-ovens would put on the market more than four times its present output of coke, while even now the increasing make of coke can only be disposed of by considerable reductions in price.

The idea that the oven coke would be used for metallurgical purposes is only true to some extent, because to produce coke for such a use it would be necessary to carbonize only selected and washed coal, in order to keep the proportion of ash within the essential limits. Moreover, the existing coke-works would not be ousted by the gas-works without an industrial struggle. Thus it may be concluded generally that the possibility of making illuminating gas by means of coke-ovens depends entirely on the possibility of disposing of the immense quantity of coke produced; and this can only arise in exceptional cases. Having regard to the figures quoted above, and the position of the coke market at the present day, the conclusion must be drawn that, so far as European conditions are concerned, coal gas supply derived from the surplus gas from coke-ovens is industrially out of the question.

Attempts have, however, been made to introduce on gas-works coke-ovens heated by means of producer gas. Herr Rothenbach made trials of such ovens at Olten; but the time required for carbonization appears to have been too long, and consequently the cost of fuel for heating the ovens was too high. The German Continental Gas Company tried a system of coke-ovens, which may be described as horizontal chamber ovens, in which the separate chambers were divided into two overlying sections. The results were satisfactory, and the system was only abandoned because greater advantages were foreseen in the vertical retort system. Recently Herr Ries, of Munich, has tried a new modification of the coke-oven, differing from the earlier ones in that the chambers are no longer horizontal but inclined. The only advantage secured is that the coke slides out instead of having to be pressed out as in the ordinary coke-oven. But whereas coke-ovens are sometimes as long as 33 feet, such a length is out of the question with inclined chambers, because of the height and the consequent cost involved in the structure. The Munich chambers are limited to a length of 13 to 16½ feet, and are not adapted for receiving coal in some conditions.

The principles of carbonization are precisely the same in the Munich chambers as in the ordinary coke-oven. It is never possible to fill the chambers entirely with coal—for mechanical reasons, and because of the fritting of the slab of coke. Consequently there is always a highly superheated space in the upper part of the chamber, through which the gas must pass. The heavy hydrocarbons are there dissociated, and naphthalene is produced, according to the experience in coke-works, but not to so great an extent as in ordinary gas-retorts, because the free space is smaller and the velocity of the gas greater. The heat of the chambers must, however, be relatively high (Herr Ries says 1250° to 1300° C.) in order to obtain a good yield of gas; and this high temperature involves risk of decomposition of the gas.

In this respect and in the mode of heating, the chamber settings differ fundamentally from vertical retorts. In the latter, the superheating space is entirely avoided, and the retorts may be so charged that the fritting of the coal does not cause the coke to drop beneath the top of the heated zone. Consequently the gas passes away without suffering decomposition. Owing to its conical shape the vertical retort needs to be less highly heated above; but the chambers must be heated alike top and bottom in order to ensure uniform carbonization. Thus the course of carbonization follows different principles in the two systems. This is indicated by the higher yield of gas, the absence of naphthalene in the gas and tar, and the higher yield of ammonia, with the vertical retort.

It seems probable that in course of time the Munich coke-oven will secure to itself the advantages of the vertical retort system by the inclined oven being put into a vertical position. Experiments have been in progress at Dessau on the enlargement of the existing vertical retort; and if they prove successful, the large vertical retort will represent to a certain extent a vertically placed coke-oven. It has been said, in favour of the introduction of the coke-oven into the gas industry, that thereby night work would come to an end. It is instructive to consider what this really implies in practice.

Firstly, even with ordinary small retorts, the time required to work off a charge varies greatly with the kind of coal, and the difference would be intensified with the larger carbonizing chambers. Thus if the Munich chambers require twenty-four hours to work off Saar coal, they would take not less than thirty hours to carbonize Durham coal properly. But as soon as twelve or twenty-four hours is departed from, the charging of the retorts in the day-time only becomes out of the question.

Secondly, even if a gas-works always carbonizes the same coal in chambers of such a size that the charge is worked off in twenty-four hours, and if the charging is done wholly in the day-time, there would be a considerable difference between the lowest and the highest hour's make. The apparatus and connections would have to be adapted for the highest hour's make, and, consequently, considerably larger than under the present conditions of a tolerably uniform make throughout the day.

Thirdly, there is no appreciable economy as compared with vertical retort working consequent on the elimination of night-work, because a watchman is required; and it has been shown at the Oberspree (Berlin) Gas-Works that one stoker per shift suffices for the discharging and charging of vertical retorts.

Fourthly, the exclusion of night work would have the further disadvantage that there would be a considerable difference between the quality of the gas made in the day time and that made at night; and uniformity in the calorific power of the gas supplied is now essential. Consequently, costly mixing arrangements would be necessary—perhaps the holders would have to be doubled.

Fifthly, with the large inclined chambers with only day working, the quenching and conveying of all the coke at one time of the day would be troublesome, and would preclude the application of continuously running De Brouwer conveyors. Either costly quenching and conveying plant must be installed, or the coke must remain and be quenched in front of the settings, to the inconvenience of the operators on that side of the bench.

Sixthly, the chambers are not so well adapted as the vertical retort for the admission of steam with a view to increasing the make of gas, because the depth of the layer of coke is less, and uniform distribution of the steam through it is attended with great technical difficulties. Even if these difficulties were overcome, and water gas were made in the inclined chambers, it could only be produced shortly before the time for drawing the retorts; and if night work were excluded, this would mean still greater want of uniformity in the quality of the gas made, owing to the whole of the water gas being produced within the space of a few hours.

For the foregoing reasons, the author concludes that the practical elimination of night work by the adoption of coke-oven working presents great difficulty. Gas-works will, he thinks, decide upon which new system of setting to adopt (provided it is reliable in working) chiefly from the point of view of economy. The future will, he says, belong to the system in which, after taking account of the capital outlay, the cost of the gas made is, *cæteris paribus*, the lowest per 1000 cubic feet.

Professor H. Le Chatelier has been officially nominated Professor of Chemistry at the Paris Faculty of Sciences, in succession to the late Professor Henri Moissan.

OBITUARY.

Sir William R. Copland, M.Inst.C.E., LL.D., died at his residence in Sandyford Place, Glasgow, on Monday last week. For some time he had been in failing health, but was able to be in London quite recently, giving evidence in support of the Renfrew County Council water scheme, of which he was the author. On his return to Glasgow he was confined to the house for about a fortnight, but immediate danger was not anticipated by his family or friends. He passed away suddenly, however, as the result of heart failure. Sir William was born in Stirling in 1838, and began business as a civil engineer in Glasgow in 1860. He rapidly acquired a very large practice in connection with water and sewage works, in respect of which he was very frequently consulted by authorities all over the United Kingdom. He received the honour of knighthood in June last year, in recognition chiefly of his services to the Glasgow and West of Scotland Technical College, of which he had been Chairman of the governing body since 1897.

Among the present generation of gas engineers, the name of Henry Finlay will not have been widely known; his part and lot in the official work of the industry having borne dates that have been deeply covered by time. Mr. Finlay was an octogenarian—in fact, he was in his 83rd year at the time of his death last Friday week. The latter three years, however, had been marred by illness which robbed him of active participation in the affairs of life. Just prior to then, he was frequently seen in the City attending those meetings that claimed his interest both in a directorial capacity and as a shareholder. Mr. Finlay was trained as a mechanical engineer at an East London millwright's. His early days in the gas industry were passed under that moulder of excellent business men, Mr. Robert Jones, of the Commercial Gas Company, and father of Mr. H. E. Jones. He was Chief Assistant (followed by the late Mr. Frank Morris) to Mr. Robert Jones, who acted as Arbitrator between Mr. Alex. A. Croll and the Surrey Consumers' Gas Company on the termination of Mr. Croll's lease. Subsequently, as Consulting Engineer to the Surrey Company, Mr. Jones recommended Mr. Finlay as Engineer to the Company. In that service he remained until the amalgamation of the Surrey Company with the South Metropolitan Company, of which Mr. Finlay became a Director, but retired after a few years, on the amalgamation with the Phœnix Gas Company. During his service with the Surrey Consumers' Company, several handsome and valuable presentations of silver were made to him, in recognition of his work; and these gifts have ever since been the admiration of his friends. Among his other occupations of later years, Mr. Finlay was a Director for a lengthened period of the Gas-Meter Company, and was for some three years Chairman. He was also a Director of the old Bahia Company, and was one of its Liquidators upon the Municipality taking over the property. Among the other interests in the administration of which he was engaged was the Hope Lighterage Company, of which he was Chairman. Mr. Finlay was very successful in his gas administration; and he enjoyed a further success in financial matters outside gas investments. It is believed he died a fairly rich man. Mr. Finlay, who was a bachelor, had a brother in the service of the Imperial Gas Company, who predeceased him. Throughout his long life, Mr. Finlay was much attached to his old chief, the late Mr. Robert Jones, and never tired of expressing his regard for, and admiration of, him. In this particular, he was emulated by his successor, Mr. Frank Morris. It is a strange coincidence that Mr. Finlay and Mr. Morris should have started in the same office, and died within a few weeks of each other. At the City of London Cemetery, Ilford, the last scene in the long chapter was closed on Thursday.

Wales and Monmouthshire District Institution of Gas Engineers and Managers.—The next general meeting of this Institution will be held in the Gas Offices, Shrewsbury, on Wednesday, the 4th prox. According to the programme issued by the Hon. Secretary (Mr. Octavius Thomas, of Pentre), Mr. Robert A. Browning, Assoc.M.Inst.C.E., the retiring President, will occupy the chair during the transaction of the opening business, and will then introduce his successor, Mr. Edward Jones, M.I.Mech.E., of Burslem (formerly of Pontypridd), who will deliver his Inaugural Address. There will be one paper—"Some Notes on the New Electric Lamps," by Mr. J. H. Canning, of Newport. At the close of the meeting, the members will visit the Shrewsbury Gas-Works; and they will subsequently be invited to tea by Mr. W. Belton, the Engineer and Secretary of the Gas Company.

Manchester District Institution of Gas Engineers.—As already announced in the "Journal," the excursion meeting of the Institution will be held next Saturday, at Worksop and the Dukeries. We learn from the programme issued by the Hon. Secretary (Mr. H. Kendrick, of Stretford) that it will be necessary to make an early start from Manchester, in order to reach Welbeck Abbey—the chief place of interest in the district—in time to obtain admission. Coaches will meet the train at Worksop, and the party will be conveyed to the Royal Hotel, where light refreshments will be served. They will then drive to the Abbey, and afterwards to Edwinstowe for "Major Oak," stopping for luncheon at the Hop-Pole Hotel, Ollerton. After lunch the drive will be continued back to Worksop, *viâ* Clumber and Thoresby, and tea will be provided at the Royal Hotel in the former town.

CAPITAL INVESTED IN THE GAS INDUSTRY.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

I have been interested in the remarks made by the President of the Institution of Gas Engineers on the respective capital indebtedness of companies and local authorities, which he sums up as follows: "It must be apparent to all that, in their treatment of capital charges, the local authorities have been wise in their generation, and that their position in years to come is likely to be a much stronger one than that of companies."

These words express emphatic approval of the policy of gradually paying off capital, as usual with local authorities, rather than allowing all capital outlay to stand as a permanent debt, as is the law in respect to gas companies. I do not understand that this matter, however, is in any sense evidence of superior business acumen on the part of local authorities. It is rather a legal accident. No doubt there are numerous boards of directors who would have been thankful, in prosperous years, to apply some of the surplus to the permanent improvement of the prospects of the undertaking, by reduction of the capital debt, but if they did so would be called to account for contravention of their Act of Parliament; and possibly there are gas committees who at times have found it a hardship to provide for the sinking fund as well as for interest on loans, and would be glad to miss a year or else to extend the time of repayment. In either case it is a matter of Hobson's choice; and the position of the companies is in no sense a reproach to them. At one time there may have been an inducement to unduly swell the capital account. But that disappeared with the introduction of the auction clauses; and I venture to think that at present the majority of gas company directors fully appreciate the importance of keeping a rigid hand on the capital account. A comparison of the accounts just published with those of thirty years ago will show that, in a general way, a much wider construction is now placed upon the words "repairs and renewals" than was formerly the rule.

As far back as 1882, I had the privilege of opening a discussion at the Torquay meeting of the South-West Association of Gas Managers on the subject of a sinking fund or of redeemable capital for gas companies; and subsequent events have proved the correctness of many of the remarks made on that occasion. The views then expressed attracted very little attention at the time. There was no discussion of the subject worthy the name, and it has scarcely been mentioned since. But having in 1882 claimed that "it is very desirable that gas undertakings . . . should have power to form sinking funds," it is gratifying to meet with such an authoritive approval of the policy. No one will dispute the fact that local authorities have largely reduced their capital liabilities. But who found the money? There is only one answer to this question; and that is the gas consumer. A person or company supplied with gas by a statutory gas company pays the company's working expenses *plus* the average interest and dividend on capital invested, and no more; but if supplied by a corporation running a thirty years' purchase, he also pays something extra, according to the position of the loan.

Table I.

1.	1882	..	£600	..	£540	..	£1,140
2.	1883	..	,,	..	522	..	1,122
3.	1884	..	,,	..	504	..	1,104
4.	1885	..	,,	..	486	..	1,086
5.	1886	..	,,	..	468	..	1,068
6.	1887	..	,,	..	450	..	1,050
7.	1888	..	,,	..	432	..	1,032
8.	1889	..	,,	..	414	..	1,014
9.	1890	..	,,	..	396	..	996
10.	1891	..	,,	..	378	..	978
11.	1892	..	,,	..	360	..	960
12.	1893	..	,,	..	342	..	942
13.	1894	..	,,	..	324	..	924
14.	1895	..	,,	..	306	..	906
15.	1896	..	,,	..	288	..	888
16.	1897	..	,,	..	270	..	870
17.	1898	..	,,	..	252	..	852
18.	1899	..	,,	..	234	..	834
19.	1900	..	,,	..	216	..	816
20.	1901	..	,,	..	198	..	798
21.	1902	..	,,	..	180	..	780
22.	1903	..	,,	..	162	..	762
23.	1904	..	,,	..	144	..	744
24.	1905	..	,,	..	126	..	726
25.	1906	..	,,	..	108	..	708
26.	1907	..	,,	..	90	..	690
27.	1908	..	,,	..	72	..	672
28.	1909	..	,,	..	54	..	654
29.	1910	..	,,	..	36	..	636
30.	1911	..	,,	..	18	..	618
			£18,000	..	£8,370	..	£26,370

To make this point plain, I may again quote from the paper above instanced. A capital outlay of £10,000 is compared (*a*) with a fixed dividend, and (*b*) with a thirty years' purchase scheme. The average rate of interest paid by the company may now be taken at 6 per cent.; and interest at this rate would, in thirty years, amount to £18,000. It is assumed that a local authority buying up this amount of capital will have to pay £18,000 for it, and would raise a loan for this amount—say, at 3 per cent. interest—payable in thirty years by equal annual

instalments. The consumers have to meet a fixed instalment of £600 a year during the thirty years, and also to pay a gradually decreasing interest. The charge, instead of being constant, will vary in each year, as shown in Table I., which illustrates a purchase supposed to have been effected in 1882. These two examples of finance are so diverse that it is impossible to make anything like a comparison on all-fours between them. Instead of paying his *quota* of £600 per annum to the company, he would pay a sum ranging from £1140 in the first year, by equal reductions of £18, down to £618 in the thirtieth year. In all he would pay during the thirty years £8370 more to the corporation than to the company. But with the thirty-first year (in this case, 1912) a new era dawns for the corporation. They now have nothing to pay; whereas the company's interest is undiminished.

It is obvious that any comparisons between the fixed capital of a gas company and the gradually disappearing balance of a local authority are fallacious, unless the total quantity raised by the corporation, and the proportion paid off, are stated. In the example before us, where is the utility of stating that in 1882 the capital of the company was the same as that of the corporation, that in 1897 it was double, and that in 1912 the corporation had no capital debt at all. It is only the natural sequence of the respective financial policies, which are beyond the control of the managing authorities in each case.

Table I. is merely a fictitious example assumed for the purpose of illustrating the fact that the consumer under a local authority will pay more for his gas than he would do if he was supplied by a statutory company during the period of repayment of capital. Whether he would obtain a compensating advantage at the conclusion of that term is a point which it is not proposed to discuss. That such a period has not yet arrived is evident from Table II., which deals with totals for the year ended Dec. 31, 1905, as given in the Parliamentary Returns. The balance available for profit on the year's working was 23·9 per cent. of the income in the case of the companies, and 26·5 per cent. by the local authorities. It is evident that, in the latter case, the consumers paid £250,000 more than they would have paid if supplied by companies, and that the consumers lose this amount through being under corporation management. If the whole belonged to local authorities, they would pay £700,000 more.

But the corporations score a point, apparently, when these factors are divided by the quantity of gas sold. It will be observed that this factor does not in any sense represent the average selling price of gas, which is really something considerably less, because the gross income includes receipts for rents and residuals. But it would appear from such a comparison that the authorities sell gas at 4d. per 1000 cubic feet less, and that the profit is the same. It might be claimed that this is a proof in favour of corporation management. It does not prove anything of the sort. We have seen that the capital of the two classes of undertakings is on totally diverse footings; and the same holds good in reference to the selling price of gas.

TABLE II.—*Receipts, Expenditure and Profit for the Year ended Dec. 31, 1905.*

	Companies.	Local Authorities.
Gross receipts	£17,617,598	£9,636,107
,, expenditure	13,410,307	7,085,710
Balance, being profit	£4,207,291	£2,550,397
Profit per cent.	23·9	26·5
Per 1000 cubic feet of gas sold—		
	s. d.	s. d.
Receipts	3 6	3 2
Expenditure	2 8	2 4
Profit	0 10	0 10

It has already been observed that the companies include a number of small concerns. The chief question with the would-be purchaser of the gas undertaking is how to conceal the facts above noticed from the consumer, who may possibly prefer gas at the lowest practicable selling price, to paying an additional loading for the benefit of posterity. He must therefore be couciliated by keeping clear of a rise of price, or perhaps receive a sop in the shape of a small reduction, and at the same time the sinking fund must be met. The most promising quarry is a concern that has followed Mr. Hunt's advice and kept the capital down, or where, for other reasons, the consumers have been accustomed to pay a fairly liberal figure, according to actual cost and local circumstances, for their gas. The current price will be taken as a standard of comparison. Or if the district admits of considerable expansion of business, the prospective profits can be counted on, and the increase that under a company would have to go to a reduction in the price of gas can be diverted into the sinking fund, and no one know anything about it. Improvements resulting in a reduction of working costs may be applied in the same way.

It follows as a natural consequence that only the best of the gas undertakings find their way into the corporation preserves. The small struggling concern in a decaying district, saddled with dear coal and iron and with other disadvantages, is not so likely to be bought up as the flourishing undertaking in the coal and iron district, combining all the advantages of cheap material, and a large consumption per mile of main and per head of population. The question of average size no doubt enters into the comparison; but the most important is the geographical one. This point is elucidated in Table III., which is simply copied from the parliamentary returns, and shows the number of undertakings in each county; and it clearly shows the preference evinced. Let us appreciate the following facts.

1.—Out of the 270 undertakings, nearly one-half are comprised in the four counties of Yorkshire, Lancashire, Staffordshire, and Cheshire. In these four counties there are 107 local authority and 113 company undertakings.

2.—That in some twenty counties there are no corporation undertakings at all. Amongst these are: Hampshire (16 companies), Middlesex (21), Surrey (20), and Sussex (18). There are also several counties where the companies are in a large majority—Essex, Hertford, Kent, Northampton, Somerset, and Wiltshire.

TABLE III.

	Companies.	Local Authorities.
Bedfordshire	6	—
Berkshire	5	4
Brecknockshire	2	—
Buckinghamshire	5	—
Cambridgeshire	4	—
Cardiganshire	2	—
Carmarthenshire	2	—
Carnarvonshire	4	6
Cheshire	13	11
Cornwall	2	1
Cumberland	1	7
Denbighshire	3	1
Derbyshire	17	6
Devonshire	12	6
Dorsetshire	4	1
Durham	12	3
Essex	19	4
Flintshire	6	1
Glamorganshire	10	8
Gloucestershire	7	—
Hampshire	16	—
Herefordshire	3	1
Hertfordshire	13	1
Huntingdon	3	—
Isle of Wight	8	1
Kent	25	4
Lancashire	28	42
Leicestershire	5	7
Lincolnshire	11	5
London	5	—
Merionethshire	1	—
Monmouth	—	4
Middlesex	21	—
Montgomery	—	1
Norfolk	6	3
Northampton	7	1
Northumberland	7	—
Nottinghamshire	3	5
Oxfordshire	4	—
Pembrokeshire	3	2
Rutland	1	—
Shropshire	5	3
Somerset	12	3
Staffordshire	15	14
Suffolk	8	1
Surrey	20	—
Sussex	18	—
Warwickshire	7	3
Westmoreland	1	3
Wiltshire	10	2
Worcestershire	6	5
Yorkshire	57	40
Aberdeenshire	—	2
Arglyeshire	—	1
Ayrshire	—	4
Banffshire	—	1
Buteshire	—	1
Clackmannanshire	—	2
Dumbartonshire	—	3
Dumfriesshire	—	2
Edinburgh	1	—
Elgin	—	1
Fifeshire	—	3
Forfarshire	—	4
Haddingtonshire	—	2
Invernessshire	—	1
Kircudbbright	—	1
Lanarkshire	2	4
Midlothian	—	1
Peebles	—	1
Perthshire	1	1
Renfrewshire	—	6
Ross	—	2
Stirling	1	3
Antrim	—	2
Clare	—	1
Cork	2	—
Down	1	3
Dublin	1	—
Fermanagh	1	—
Kerry	—	1
Limerick	—	1
Londonderry	1	1
Louth	1	1
Sligo	1	—
Tipperary	—	1
Tyrone	—	2
Waterford	1	—
Wexford	1	—

What are the conditions with regard to the price of coal and iron, the consumption per mile and per consumer, the prospects of large consumption for technical purposes, and other causes that influence both capital and selling prices in regard to the four counties in Class I., as compared with the ten counties named in Class II.? It is not necessary to labour such an obvious point. No fair comparison can be made between such varying circumstances. Where is the fairness of comparing the capital and selling price in Yorkshire with that in Sussex, or Lancashire with Kent. If a comparison is wanted, it should be not only between undertakings of the same size, but of the same district. Under present circumstances, the predominance of the local authorities in the fat counties and their absence in the lean ones renders anything like a fair comparison impossible. In a fat county the price of coal may not exceed three times the selling price of gas; in a lean county, coal may cost six times as much. The same holds good with iron, though in a lesser degree.

What will be the practical effect on the position of gas companies when the local authorities have all attained to that possession of a financial Nirvana promised as the reward for buying up the gas undertaking? Will they reduce their prices to an extent sufficient to place the neighbouring gas companies in an invidious position, or lead to the confiscation of such undertakings as a necessary sacrifice to the public welfare? Time alone will show. Sufficient for the day is the evil thereof.

Referring to companies only, there are several ways by which the capital liability can be reduced, or, in other words, the proportion between capital and revenue. The secret of good financial management consists largely in a correct and fair adjustment of these two accounts. The output can be increased by adopting improved processes, such as those which increase the make per mouthpiece or per ton of coal. Obsolete and unused or worn-out plant can be replaced at the expense of the revenue account. But apart from this, there is a quantity of outlay, such as that for meters or appliances on hire, which cannot fairly be called permanent capital. A meter or stove costing £2 is not worth £2, or anything like it, after three months' use. At best, it would not realize 50 per cent. of its cost in the open market. Why, then, should the concern be saddled with a permanent debt of £2 for it? I still hold that gas companies might with advantage adopt

some plan for redeeming a portion of their permanent capital, and that what we might call incidental income, such as a part of the excess profits during an exceptionally favourable year, the interest on reserve investments, or the premiums received on capital issued by auction, might well be applied for this purpose. The concern would be benefited more than if the balance lay idle in Government securities at 2½ per cent.

COLOUR VALUES OF ARTIFICIAL LIGHTS.

The recently published transactions of the Illuminating Engineering Society for the month of May include a report of a lecture on "Colour Values of Artificial Illuminants," delivered by Mr. G. H. Stickney before the New York Section of the Society. The lecturer presented some experiments bearing upon the neutralization and interference of light rays; and he also dealt with the colour difficulties encountered in matching goods under various illuminants.

Mr. Stickney pointed out the difference in composition—that is, in the proportion of different colours—which exists between artificial lights and daylight. In all cases where the so-called "daylight balance" of colours is not maintained, the light ceases to be white; the excess or absence of some particular colour being noticeable in the colour effect and the general lack of clearness. Instances of the effect of colour are given. For example, it is known that the mercury arc does not contain any appreciable amount of red; and a piece of material which would reflect red rays under a white light would appear black by total absorption under this light. Yellow materials displayed in the light of the Nernst or incandescent lamps become pronounced, and slight differences in pale yellow are hardly distinguishable from white. The same relation exists between green and white exhibited under the Welsbach gas or vapour hydrocarbon lights.

Direct and alternating current enclosed arcs emit an excessive amount of violet light when equipped with clear globes, so that blue and violet materials under this light are stronger in tone than in daylight. The excess violet light can be corrected by opal enclosing globes and other means.

Mr. Stickney referred to three instruments used in contrasting lights for colour matching and selection—viz., the lumichromoscope, the photochromoscope, and the parachromoscope; and he stated that with any of these instruments the effects of various lights on coloured fabrics can be compared. The first-named instrument is described as the most practical for general demonstration purposes. The apparatus is arranged so that four lights —say, the arc, Welsbach, Nernst, and glow lamps—fall simultaneously on the material to be examined. Each light forms a patch 2½ inches square with a black border separating each square so as to reduce simultaneous contrast or gradation. The lamps are placed at such a distance that the relative intensity of the different lights falling on the material is the same; thus eliminating tint and shade effects which take place when the intensities are of unequal strength.

The lecturer then gave the following table showing the effect of coloured lights on aniline-dyed materials. The observations are from tests made by M. Chevreul at the Gobelins Tapestry Works in Paris, with some additions by Mr. W. D'A. Ryan.

Colour.	Appearance Under Orange Rays.	Appearance Under Red Rays.
White	Orange	Red
Red	Reddish orange	Deeper red
Orange	Deeper orange	Orange red
Yellow	Orange yellow	Orange
Green	Dark yellow green	Yellowish grey
Blue	Dark reddish grey	Violet
Violet	Dark purplish grey	Purple
Black	Brownish black	Rusty black

Colour.	Appearance Under Yellow Rays.	Appearance Under Green Rays.
White	Yellow	Green
Red	Orange brown	Yellowish brown
Orange	Orange yellow	Greyish leaf green
Yellow	Deeper yellow	Yellowish green
Green	Yellowish green	Deeper green
Blue	Slaty grey	Bluish green
Violet	Purplish grey	Bluish grey
Black	Olive black	Dark greenish grey

Colour.	Appearance Under Blue Rays.	Appearance Under Violet Rays.
White	Blue	Violet
Red	Purple	Purple
Orange	Plum brown	Reddish grey
Yellow	Yellowish grey	Purplish grey
Green	Bluish green	Bluish grey
Blue	Deeper blue	Bluish violet
Violet	Deep bluish Violet	Deeper violet
Black	Bluish black	Violet black

The lecturer remarked that the arc lamp is the most efficient source of artificial illumination; but as high efficiency generally goes hand in hand with high intrinsic brilliancy, he did not regard the arc in its distribution as by any means the ideal for general interior illumination—the objection being partly met by the use of low-power lamps. Mr. Stickney considered the enclosed arc lamp as best for interior mercantile lighting where colour values are of importance, but preferred a yellow-tinted light for places such as restaurants, residences, and the like.

A further table was furnished showing the predominating colour of artificial lights—

Lamp.	Colour.
Enclosed arc—clear globes	Bluish white
,, ,, opal globe and selective diffuser	White
Nernst lamp—new glower	Pale lemon yellow
,, ,, seasoned glower	Deep ,, ,,
Incandescent glow—new	Yellow
,, ,, seasoned	Pale orange yellow
Welsbach and vapour hydrocarbon—new	Greenish white
,, ,, ,, seasoned	,, yellow
Ordinary gas flame	Reddish yellow
Mercury arc lamp	Blue green

In the discussion which followed the lecture, Mr. D. M'Farlan Moore advocated as a standard the use of the vacuum tube filled with carbon dioxide at a definite pressure and intensity; this furnishing a light more closely approximating daylight than any other light produced. He said dye-works experts had not been able to detect any difference between the most delicate lavender shades when matching at night under this tube and in the daytime by daylight. Such a standard could be used for the comparison of coloured lights. For instance, if it were claimed that a certain light had a pink colour, it could be expressed as pink compared with the carbon dioxide light. Mr. Moore went on to remark that the efficiency of any light source is largely dependent upon its colour; but a subsequent speaker—Mr. G. L. Hunter—rightly added that the efficiency varies also with the colour of the walls, and that in practical illumination they cannot be dissociated. Mr. Moore emphasized the fact that yellow rays have a maximum effect upon the eyes; and he drew attention to the efficiency value of a light which predominates in yellow or green as compared with a larger number of prominent colours.

A later speaker—Dr. H. H. Seabrook—dealt with the question from a physiological point of view, and referred to the effect of coloured rays upon the eye. He pointed out that the anterior structures of the eyes are inflamed and the human lens is injured by ultra-violet rays. The lens absorbs the rays to a variable extent; thus protecting more or less the posterior structures. It has been shown, as might be expected, that the blue and violet spectral lights cause damage less in degree to ultra-violet rays. Dr. Van Generen Short found in 1887 that the chemical rays of light which are not absorbed by the lens of the eye produce disassimilation of the retinal pigment. He noted further that the disassimilation and cell wandering is at a minimum in yellow light, which is, of course, the light which contains the luminous rays in the greatest quantity.

Mr. T. A. Litle, jun., pointed out that the best mantles had not been employed in obtaining the results given by the lecturer; those used giving a greenish white light. He said that, in order to give the Welsbach mantle a mellower light, the cerium content had been increased, with the result that there were more red rays, with neutralization of some of the green rays.

Turning to the report, in the same issue of the "Transactions," of a topical discussion on photometrical instruments which took place before the New England Section of the Society, we find that the question of the effect of colour in artificial lights again cropped up. Professor G. C. Shaad gave a short account of tests made of illumination obtained from mercury vapour and carbon incandescent lamps; the two systems being combined in the hope that the red rays from the latter would correct the distinctly green light of the former, and produce a result approximating to daylight. A curious increase in the total illumination resulted from the combination as compared with the sum of the illumination obtained from each system tested separately. The room in which the tests were conducted measured 44 ft. by 25 ft. 6 in. and 12 feet high, and was finished in a light yellow tint. The Weber photometer used for testing is stated as giving excellent results with the incandescent lamps, and also with the combination. When used with the mercury vapour lamps alone, however, difficulty was experienced in getting balances due to differences in colour of the standard and of the lamps tested, though two experimentalists differed only to the extent of 5 per cent. in their readings. The interesting feature of the tests is found in the fact that while the average illumination obtained with the carbon incandescent lamps alone was 1·1 candle-feet, and that of the mercury vapour lamps 2·5 candle-feet, the average illumination obtained with both systems in use together amounted to 4·5 candle-feet, which is much greater than that given by adding the two averages obtained separately (3·6).

Professor Shaad suggested three possible explanations. The first was error in the calibration of the instrument. But this had been checked and found to be correct. The second referred to the discrepancy due to the use of a photometer of this type in comparison of lights differing in colour. This seems reasonable, but does not account, according to the Professor, for so large a discrepancy. The remaining explanation is that the combination of the red rays which are prominent in the incandescent lamp with the green of the mercury lamp gives a condition which, measured by the eye, afforded better illumination; in other words, the combination gives a colour of light by which things can be perceived with greater distinctness—the light appearing to be of higher intensity than with either light alone. The Professor's own opinion, expressed at the conclusion of the contribution, was that the discrepancy found was largely owing to the attempt to measure illumination, due to such colour sources, with the Weber photometer.

METROPOLITAN WATER BOARD.

Fourth Annual Report.

We have received from the Clerk of the Metropolitan Water Board (Mr. A. B. Pilling) a copy of the fourth annual report, covering the twelve months ending the 31st of March last, which has lately been issued. It furnishes a large amount of statistical and other information in regard to the supply of water in the Board's area, which extends to upwards of 537 square miles, and comprises six Administrative Counties—viz., the whole of London and parts of Essex, Hertford, Kent, Middlesex, and Surrey.

The first section of the report deals with the constitution of the Board, the Chairman of which, as our readers are aware, is Sir Melvill Beachcroft. The administrative work is entrusted to six Committees—Appeal and Assessment, Finance, General Purposes, Law and Parliamentary, Water Examination, and Works and Stores. In the second annual report, reference was made to the steps taken to consolidate the undertakings under one administration, and their organization into five main branches under the Board's principal officers—the Clerk, Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.), Comptroller (Mr. F. E. Harris), Solicitor (Mr. W. Moon), and Director of Water Examinations (Dr. A. C. Houston). This organization was maintained during the year under review. Acting under the provisions of section 47 of the Metropolis Water Act, 1902, the Board granted in 66 cases superannuation allowances to officers and servants transferred from the Water Companies; bringing up the number to 155 since the "appointed day." There were 39 offices abolished in the year; making a total of 77 since the Board took possession. At the end of June, there were 122 chief officers and assistants in the service of the Board; and the entire staff consisted of 770, whose total salaries amounted to £154,861, or at the rate of £201 2s. per head.

The second section of the report deals with financial matters. In the two preceding reports, an account was given of the arbitration proceedings in relation to the transfer of the water undertakings and matter arising out of them. As these were finally closed during the year ending in March, the salient features are recapitulated. The claims of the Companies amounted to £50,939,198, and they were settled for £30,662,323. The acquisition of the undertakings of the Urban District Councils of Tottenham and Enfield cost £151,980 (Tottenham £79,150 and Enfield £72,829 14s. 4d.); while the sale of portions of the undertakings in Croydon and Richmond yielded £260,810 (Croydon £225,810 and Richmond £35,000). The compensation awards to the Companies were discharged by the issue of £32,818,609 of the Board's "B" stock (equivalent to £29,971,332 in cash), and by the payment of a cash balance of £690,991. In addition, a total claim was made for £316,726, Directors' compensation for loss of office; and it was settled for £219,287. The expenses of the Court of Arbitration amounted to £21,016, after deducting £4221 generously returned to the Board by Sir Edward Fry and Sir Hugh Owen. The net cost of the acquisition of the several undertakings may be stated to be £31,149,005 cash, exclusive of the debenture stocks and mortgage loans tranferred from the Companies to the Board, which amounted in all to £11,624,948. The capital debt of the Board is divided as follows: "A" stock, £6.060,165; "B" stock, £34,110,226; redeemable debenture stocks, mortgages, &c., £7,236,638—total, £47,407,029. The annual charge for interest is £1,426,431, or equivalent to 4·2d. per 1000 gallons of water supplied.

In the third section, the subject of the Board's assessments is dealt with. As showing the large amount of detail work carried out in the Supervisor's branch of the Clerk's department under the direction of the Appeal and Assessment Committee, it may be mentioned that no less than 48,956 communications were registered as having been received during the twelve months covered by the report, and 16,936 letters and memoranda despatched from this section alone. This volume of correspondence resulted in 5517 building supplies arranged for, 2476 meter transactions completed, 120 new fire supplies laid on, 65 special agreements executed for supplies in respect of non-rated premises, and 360 pipe guarantees obtained in respect of extensions of mains. Moreover, in consequence of the quinquennial revision of the valuation lists throughout the Administrative County of London, the water charges of no less than 246,465 premises out of a total of 638,881 had to be revised. In 173,532 cases, the charges were increased in the aggregate by £71,773, and in 72,933 cases they were reduced in the aggregate by £16,456; the result being an increase of gross revenue of upwards of £55,000, or nearly £25,000 in excess of the previous revision.

Perhaps the most interesting section of the report, from our readers' point of view, is the fourth, which furnishes particulars relating to the supply of water. The Board's sources of supply are four in number: (1) the Rivers Thames and Lea; (2) gravel beds adjoining the main stream of the Thames and other gravel beds at Hanworth; (3) natural springs; and (4) wells sunk in the chalk or other strata in the Lea Valley on the north of the Thames, in Kent, and at certain other points to the south of the Thames. The Thames furnished 57·263 per cent. of the Board's supply, compared with 56·432 per cent. in the year 1905-6. The total quantity of water supplied was upwards of 82,125·2 million gallons; the average daily supply being 225 million gallons. Of this, the southern district took the largest proportion—28·313 per cent.; the Kent district the smallest—9·009 per cent. The East London district was dependent for its supply upon the Rivers Thames and Lea, eleven wells in the Lea Valley, and the gravel beds at Hanworth. It obtained 57·002 per cent. of its supply from the Lea, 20·029 per cent. from the Thames, 21·628 per cent. from wells, and 1·341 per cent. from the gravel beds. The district consumed 18·690 per cent. of the total supply in the Board's area, compared with 19·516 per cent. in 1905-6. The New River district derived its supply from the Lea, the Chadwell spring, eighteen wells in the Lea Valley (most of which feed the New River channel), and from the Thames. The latter supply is obtained indirectly from the Staines reservoirs through the Grand Junction and West Middlesex systems pending the completion of the Staines communication works, and from the Southwark and Vauxhall division by way of the intercommunication works at Battersea. A small supply for non-domestic use is also obtained from the Hampstead and Highgate ponds. Of the total supply to the district, 46·418 per cent. was obtained from the Lea, 6·185 per cent. from the Thames, 47·195 per cent. from wells and springs, and 0·202 per cent. from the ponds.

The southern district (comprising the Lambeth and Southwark and Vauxhall divisions) derived its main supply from the Thames, with a supplementary source from wells at Selhurst (Lambeth) and at Streatham, Honor Oak, and Merton Abbey (Southwark and Vauxhall). The total supply of the district from the Thames was 97·686 per cent., and from the wells 2·314 per cent. The Lambeth division obtained 96·054 per cent. of its supply from the Thames, and 3·946 per cent. from the wells; the Southwark and Vauxhall division, 99·401 per cent. from the Thames, and 0·599 per cent. from the wells. The Merton Abbey Well was brought into use for the first time in July, 1906, and was pumped during that and the three succeeding months. The western district (which comprises the areas of the Chelsea, Grand Junction, and West Middlesex Water Companies) is supplied wholly from the Thames. In the year under review, Chelsea took 22·686 per cent., Grand Junction 32·287 per cent., and West Middlesex 45·027 per cent. of the total supply to the district.

There was a general increase in the supply from the Thames to every district, from a total of 44,904 million gallons in 1905-6 to 47,028 million gallons in 1906-7—equal to a percentage increase of 4·729. The New River district increased its supply from the Thames by nearly 60 per cent. The southern district took 48·3 per cent., and the western district 43 per cent. of the total supply derived from the Thames. The eastern district took 0·974 per cent. less from the Lea and 3·659 per cent. less from the wells. The New River decreased its supply from the Lea 0·102 per cent., but increased it from the wells by 6·145 per cent. The New River had the larger percentage of the Lea Valley well water—69·285, against 30·715 received by the eastern district. As regards the Lea river water, the eastern district took 54·295 per cent., and the New River district 45·705 per cent. of the total supply.

Tables contained in the numerous appendices to the report show that the total supply derived by the Board from the wells in the year 1906-7 amounted to 18,744·9 million gallons in total volume, or to 51·4 million gallons average daily supply, of which volume the wells north of the Thames yielded 57·660 per cent., and those south of the Thames 42·340 per cent. There are no wells in the western district. The Kent district, which is wholly supplied with well water, received 39·470 per cent. of the total supply from this source, which is the purest of those at the command of the Board. In the latter district there was a total increase of 518·9 million gallons supplied as compared with the previous year, representing an increase of 7·543 per cent. In the southern district, there was a percentage decrease of 11·519 from this source.

Other tables give particulars of the supply in the months of maximum and minimum average daily supply during the year. The average per head ranged from 45·43 gallons in the Chelsea division to 30·19 gallons in the eastern district during the maximum month; the general average being 36·74 gallons as compared with 37·58 and 39·73 gallons in the two preceding years. There was over the whole of the Board's area a continued reduction in the supply furnished during the maximum month—viz., 0·714 per cent., compared with 2·144 per cent. in 1905-6. With regard to the month of minimum average daily supply, the rate per head per day ranged from 37·22 gallons in the Chelsea Division to 24·83 gallons in the eastern district; the general average during the minimum month having been 30·13 gallons, compared with 29·63 and 30·62 gallons in the two preceding years.

The total estimated population supplied by the Board at the close of the year was 6,893,780, representing no less than 15·8 per cent. of the population of Great Britain and Ireland. The average estimated population supplied during the year was 6,851,045. Of these, 3,611,118, or 52·709 per cent., had Thames water; 1,518,195, or 22·160 per cent., Lea water; and 1,721,732, or 25·131 per cent., water derived from springs and wells. The average daily supply per head per day over the whole area was 32·84 gallons, against 32·31 gallons and 33·54 gallons in the two immediately preceding years. The average daily supply per service was 213·46 gallons, compared with 210·52 gallons and 219·80 gallons; and the average population supplied per service was 6·5, against 6·52 and 6·55.

On the important subject of constant supply, the statistics appended to the report show that of the total of 1,061,428 services

in use on the 31st of March last, 1,021,502, or 96·24 per cent., were on the constant system; being an increase of 0·94 on the figures for 1905-6. In the Kent district, constant supply is given throughout, with the exception of some 300 services on Shooter's Hill; and this is to be remedied by a water-tower or tank to be erected on the summit, for the purpose of maintaining a constant supply in this district. The percentage on constant supply is 99·71. In the New River district, constant supply is given to the Metropolitan portion, and to the whole of the district outside the Metropolis, except parts of Enfield and Tottenham transferred under the Metropolis Water Act, 1902, as regards water supply, from the jurisdiction of the Urban District Councils to the Board, and except also a few houses in the village of Great Amwell. The percentage of services on constant supply in December, 1904, was 99·9. The figures for Tottenham and Enfield, first included in January, 1905, had the effect of reducing this percentage; but the added areas are being brought under the constant system as soon as practicable. The percentage on constant supply in the district is 94·10. As regards the southern district, in the Lambeth division constant supply is in contemplation for Thames Ditton. The percentage on constant supply in the division is 81·12. The whole of the eastern and western districts and the Southwark and Vauxhall division are on constant supply. The increase in the number of services on the constant system during the year was 27,276, or 2·743 per cent.

The rest of the report deals with storage, filtration, and other engineering matters, which may be left for another article.

MEANS OF ILLUMINATION IN RUSSIA.

Dealing with the announcement that the Russian Government has at last made up its mind to impose the tax on coal gas and electricity that has been talked about for a long time, Herr P. Martell wrote an article in a recent number of the "Zeitschrift für Beleuchtungswesen" which contains some interesting figures showing the consumption of gas, paraffin, and electricity in Russia at the present time. A tax on paraffin was imposed in 1887 at a time when the oil was affording about 94 per cent. of all the artificial light developed, and when the consumption was about 20 million pud, equal to a production of 76,800 million candle hours of illumination.

In order to collect the necessary information for calculating the amount of tax to be imposed, the Russian Government instituted certain inquiries during July, 1906, which cover all the districts of the country with a few exceptions, but do not include Finland. At the time when the replies were collated, there were 32 public and 95 private gas-works in Russia, which made altogether about 3317 million cubic feet of gas during the year 1906. Of this total, about 2800 millions were employed to generate light, the remaining 500 millions being used for motive and other technical purposes. At the same time, there were 132 public and 5326 private electricity stations which developed nearly 482 million kilowatt hours of energy. Of this total, 222 million kilowatt hours were used to afford light, and 260 millions were consumed for motive and other technical purposes. Comparing the individual figures relating to gas and electricity, it is interesting to notice that the commercial gas undertakings were providing 92 per cent. of the total gas manufactured, the private works only making 8 per cent. On the other hand, the public electricity generating stations were only developing 20·8 per cent. of the total current, the private plants generating 79·2 per cent. Even in the large towns fitted with public electricity supplies, the bulk of the current consumed was being made by owners of private plants. For example, in St. Petersburg some 72 million kilowatt hours were consumed in 1905, of which the private dynamos generated roughly two-thirds. In many of the large cities the public electricity supplies were only generating about 28 per cent. of the total current consumed, even when an allowance was made for the current taken by the electric tram lines. The total make of the public gas-works in Russia during 1906 was 3056 million cubic feet. Of this quantity, 1851 millions were supplied to private consumers for consumption in illuminating burners, 461 millions were employed in motors and for trade purposes, 686 millions were used in street-lamps, 56 millions were consumed to furnish light, and 1 million to afford power on the works. The private gas undertakings manufactured 208 million cubic feet for the production of light, and 54 millions to drive engines and do other work.

At the period under review, 56 towns in Russia, all of them being what are termed "Government towns," were provided with electric street-lamps; while 20 towns, 13 of which were Government towns, had gas-lamps. Nine towns were provided with both electric and gas lamps in the streets. Hence the majority of towns in Russia were still being lighted by means of paraffin. Even at St. Petersburg there were 5794 paraffin lamps in the streets in addition to 134 arc lamps, 1722 electric glow-lamps and 8446 gas-lamps. The consumption of electricity is increasing, but is not replacing paraffin or gas, as the Russian people are simply demanding more artificial light. At a time when the consumption of paraffin was 18·87 million pud, the population was 106 million; so that the consumption per head per year was 7·12 Russian pounds. By 1905, the consumption of paraffin had increased to 44·13 million pud, the population had increased to 144 million, so that the consumption per head was 12·25 Russian pounds. In other words, the population during the last two decades had increased by 30 per cent.; while the total consumption of paraffin had increased by 134 per cent., and the consumption per head by 72 per cent. Only about 1 or 2 per cent. of the paraffin was used for purposes other than the production of light. It may be calculated that the amount of light afforded by the paraffin consumed is now equal to 169,459 million candle-hours, which should represent about 50 per cent. of the total light developed in Russia.

The idea of the Russian Government is to impose a tax at the rate of 4 kopecks per B.T.U. on electricity consumed as an illuminant, and at the rate of 1 kopeck when the current is employed for other purposes; the total revenue being expected to reach 8·84 million roubles from the lighting current, and 2·60 millions from the remainder. The proposed gas tax is expected to bring in 1·1 million roubles from the gas consumed as an illuminant, and 0·1 million from that which is used for other purposes.

THE BAMAG GAS-LIGHTING APPARATUS.

Among the papers read before the last meeting of the Austro-Hungarian Association of Gas and Water Engineers, a description was given by Herr Schlegel, of Berlin, of the new distance gas-lighter, known as the "Bamag."

According to the text of the author's communication printed in "Gastechniker," the apparatus is one which turns up or down from any distant spot a burner fitted with a pilot-flame by means of a temporary increase in the pressure of gas. The appliance is constructed of a small cast-iron vessel divided into two compartments by a flexible diaphragm. One of the compartments is in communication with the gas service-pipe, while the other contains a spring impinging against the diaphragm which can be adjusted by the aid of a movable lever in such fashion that the spring takes the whole of the pressure of the gas upon the diaphragm. Hence alterations in the pressure cause the diaphragm to move one way or the other. The motion of the diaphragm is communicated to a system of levers, which ultimately move a mushroom valve on the burner-pipe. This valve is of such weight as of itself to close the gas-way when the gas stands at normal pressure, but to be lifted off its seat by any increased pressure. The manner in which the valve is moved through the agency of the system of levers depends on a special toothed wheel (the essence of the whole invention), which is caused to revolve by a ratchet. According to the position and depth of the indentations on the toothed wheel, two successive impulses, given either by loading the governor at the gas-works or by temporarily opening a bye-pass, cause all the burners fitted with the lighter first of all to be turned on and secondly to be turned down.

By fitting some of the burners on the same main with toothed wheels of one particular design and others with toothed wheels of a different pattern, it becomes possible to light all the gas-burners at the same time, but to extinguish those of one class before the others. This is effected by inserting in the apparatus attached to the burners which, for example, are to remain alight all night in the streets, such toothed wheels that the first impulse of all lights them from their bye-passes; the second impulse, which extinguishes certain other burners intended to be put out at the end of the evening, leaves the all-night burners untouched; while the third impulse puts out the latter, and does not affect the evening burners. Thus the all-night burners are affected by the first and third impulses, and untouched by the second; whereas the evening burners are affected by the first and second impulses, and are untouched by the third. The toothed wheels themselves, which are, of course, replaceable, are situated inside chambers secured by means of a key. Therefore, in the rare event of the lighter failing to act when an appropriate impulse is sent over the district, the wheel can be taken out by the attendant, exchanged for a fresh one, or moved round into the position it ought to occupy. It will be obvious that the Bamag lighter does not involve any second service pipe or pneumatic tube. It costs about 25 marks per lantern to instal, and in German conditions leads to an economy of from 6 to 8 marks per lantern-year, over and above the saving in gas due to the whole of the lanterns being lighted and extinguished simultaneously.

Herr Schlegel stated that 10,000 of the distance lighters referred to had already been installed in Germany, and had proved to work successfully. In Austria, 170 had been fitted at Villach, and 318 at Pola. The managers of the gas-works at both places had expressed their complete satisfaction with the installations.

Assessment of Gas and Water Works for Income-Tax.—According to the fiftieth report of the Commissioners of Inland Revenue just issued, the gross income assessed in respect of gas-works for the year 1905-6 was £7,413,611. Compared with the preceding year, there was a decrease of £192,919, or 2·5 per cent.; compared with 1896-7, there was an increase of £1,884,155, or 34 per cent. Water-works have shown a gradual increase from 1896-7 to 1905-6. In the latter year, the gross income assessed was £5,816,300, or £1,800,984 more than in the former one—being equal to 44·8 per cent. In the year 1904-5, the assessment was £5,327,082, or £489,218 less than in the succeeding year.

HOT-COKE CONVEYING PLANT AT THE PARIS GAS-WORKS.

Experiments with a Water-Jet Conveyor.

It may, with some degree of truth, be said that the problem of quenching and conveying hot coke, though it has occupied many engineering minds for a long time, has never yet been so fully and so satisfactorily solved as is to be hoped for. As is well known, and as our past "Register of Patents" testifies, the attention of inventors—or of those who file patent specifications (for the terms are not synonymous)—seems to be given at particular times to particular matters. The vogue of hot-coke conveyors may perhaps be put down as between the years 1890 and 1903. After the latter year, attention was directed more to improvements in stoking machinery and to the possibilities of vertical retorts. Had it not been, perhaps, for these later distractions, further mechanical skill might have been devoted to the difficulties of carrying hot coke, and the problem more perfectly solved than has been the case.

It may also be reasonably considered that the newer and more "pushing" forms of retort-discharging machines have given rise, to some extent, to different requirements and arrangements for dealing with the expelled hot coke, discharged as it is in one long, live stream from the retort. The newer stoking-machines necessitate newer conveying appliances. As the former were early and extensively experimented with by the late Paris Gas Company—more especially at their La Villette works—it is natural that the latter should also receive every trial at the hands of the engineers in the Paris Gas-Works. The columns of the "Journal" have, from time to time, contained references to hot-coke plants which have been put up in Paris, and elsewhere in France; and our attention has just been drawn to the latest experimental hot-coke conveyor which is being tried at La Villette works, and which may be called a "water-jet" conveyor; for the coke is quenched and carried along a trough by a swift-flowing stream of water.

We will describe it later in the words of M. Thibeault, an engineer of Arts and Manufactures, who has contributed an interesting article to "Le Génie Civil" of the 3rd inst., on the subject of "Coke Quenching and Conveying in Gas-Works." His paper is well illustrated, and we reproduce some of the newer diagrams given, as well as summarize certain of his statements.

Difficulties of Quenching Hot Coke.

Preliminary reference is made to the arduous work of drawing, dragging, tipping, and extinguishing incandescent coke from coal-gas retorts. The mere throwing of water over the coke is hard enough, as it is calculated that 65 litres of water are required for every 100 kilos of coke. This is roughly the equivalent of about 7 gallons per hundredweight. Further, the wheeling out of the coke to the yard represents about 15 per cent. of the retort-house labour; the carrying of water is approximately 7 per cent.; and the shovelling of the coke into heaps accounts for 12·5 per cent. This labour can be facilitated, as has been done at the Saint Mandé and Vaugirard works of the Paris Gas Company. The coke drops through hinged doors in the retort-house flooring directly on to a quenching pavement below. After being sprayed with water from a hose-pipe, the coke is loaded into carts standing at the lower side of the quenching platform. Apparently there are no mechanical appliances at these works; and in such places a shower coke-quencher is often useful. Fig. 1 shows an apparatus designed by M. Sainte-Claire Deville, and adopted throughout the Paris Gas Company's works. Its advantage is that it regulates the amount of water used according to the weight of coke to be quenched; and, further, it effects some considerable economy in the water consumed. After being placed in a dry

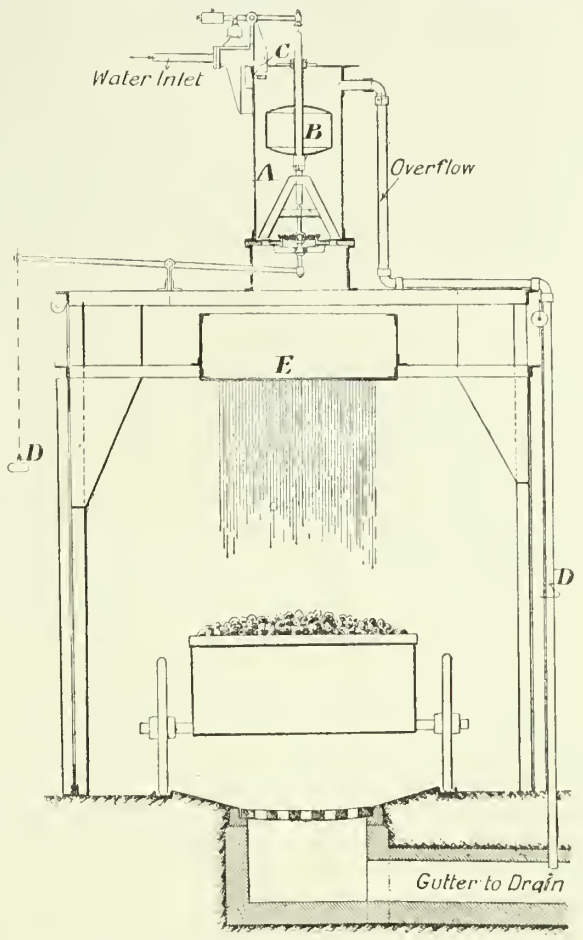


Fig. 1.—The St. Claire Deville Coke Quencher.

yard, the coke thus quenched does not contain more than $2\frac{1}{2}$ per cent. of water. The apparatus consists of a measuring-tank A, in which a float B regulates the inlet water-cock C. The bottom of the measuring-tank is closed by an india-rubber valve. It is worked by levers and a chain D. During the emptying, the valve-shaft keeps the float raised, and thus the cock C is closed. When

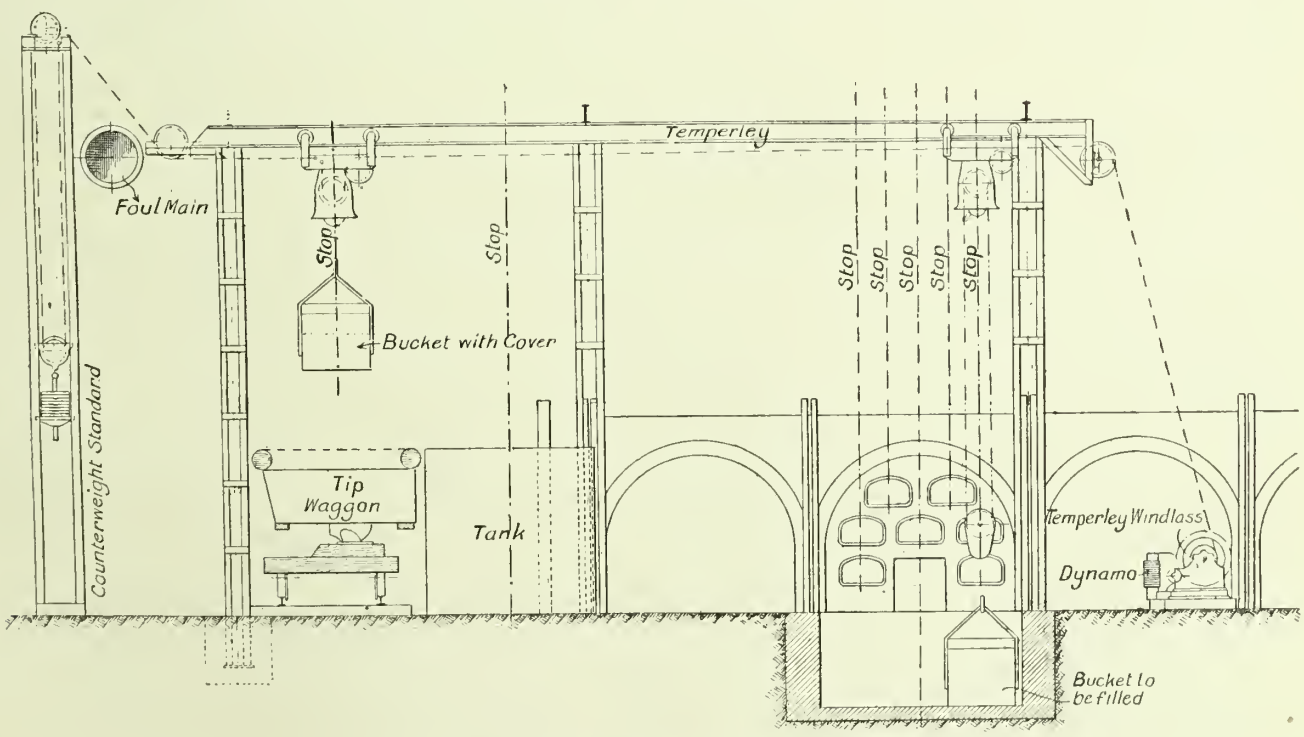


Fig. 2.—The Temperley Transporter Adapted to Carrying Hot Coke.

the valve is worked, the water from the measuring-tank runs rapidly into the box E, the bottom of which is perforated. The shower of water thus produced quenches the coke; any excess running into the gutter. M. Sar's apparatus, designed on similar lines, is also described and illustrated.*

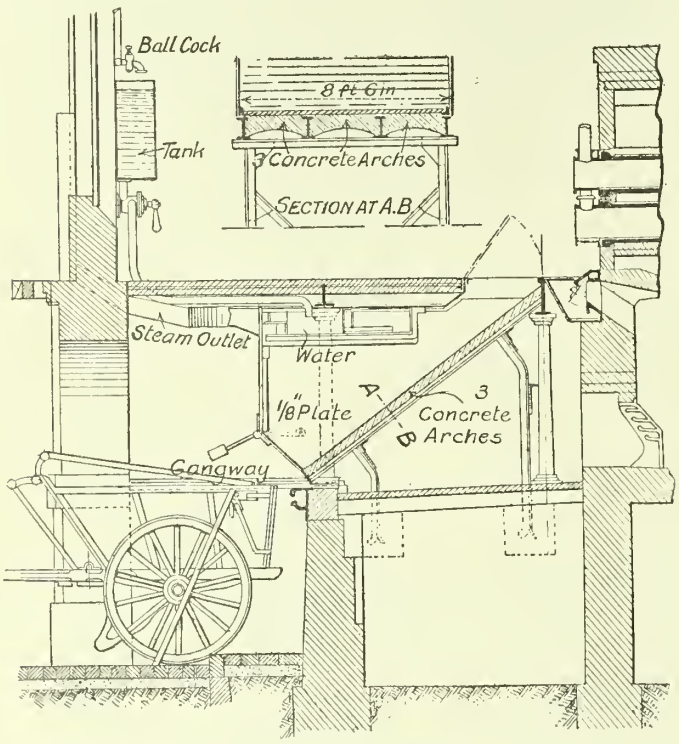


Fig. 3.—The Coke Quenching Closed Hopper at Vaugirard Gas-Works.

Paris Experiments with Hot-Coke Conveyors.

Mechanical coke-conveyors are then mentioned, the De Brouwer being given first place. Messrs. Graham, Morton, and Co.'s solution of the hot-coke problem, as carried out at the Nanterre Gas-Works, is incidentally referred to. At Mulhouse, the coke coming from inclined retorts falls into aërial buckets suspended from rails. They carry the incandescent coke, and deposit it in the yard. It is cooled principally by being spread out; quenching by water being supplementary. Such a system requires plenty of space, besides which the re-handling of the coke for breaking or loading is costly. The output of all these appliances is limited, and their upkeep is heavy. Especially is this the case when, as with the Paris Gas Company, the coke from a 6-metre (20-feet) retort has to be dealt with in 16 seconds—*i.e.*, the time taken to discharge the retort with a pushing-machine. What this means is shown by the following figures:—

	Carbonization in		
	Four Hours.	Six Hours.	Eight Hours.
Weight of coke.	210 kilos. (463 lbs.)	315 kilos. (694 lbs.)	425 kilos. (937 lbs.)
Volume of coke.	5·55 hectolitres	8·32 hectolitres	11·11 hectolitres
Calories	73,500	110,250	147,000

Numerous trials have been made by the Paris Gas Company with hot-coke conveyors, all directed to the end of reducing the arduous labour involved, and of obtaining large pieces of coke with the least possible dust, and with a quantity of water lower than 5 per cent.—the coke being at the same time perfectly quenched. One of the first attempts was with an adaptation of the Temperley transporter (see fig. 2). It carried the hot coke from the retort-house to a quenching-tank. The ordinary open bucket of this apparatus was replaced by one with spaced bars and with a cover. But the sudden immersion broke the coke; and there were difficulties with the water. Moreover, the passing overhead, on an aërial way, of a

* See "Journal," June 30, 1903 (Vol. LXXXII., p. 956).

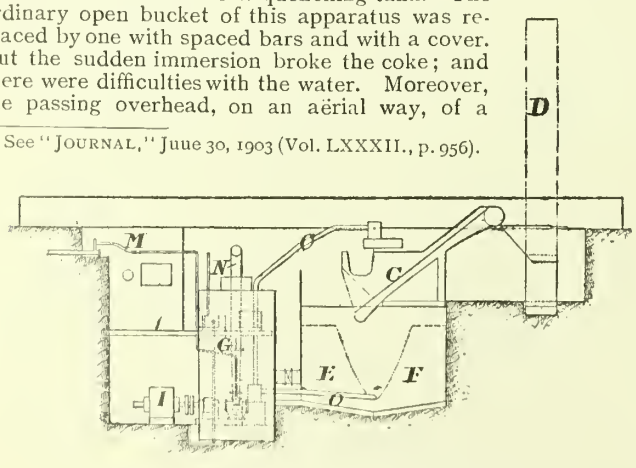


Fig. 5.—Section through the Line G H (Fig. 4).

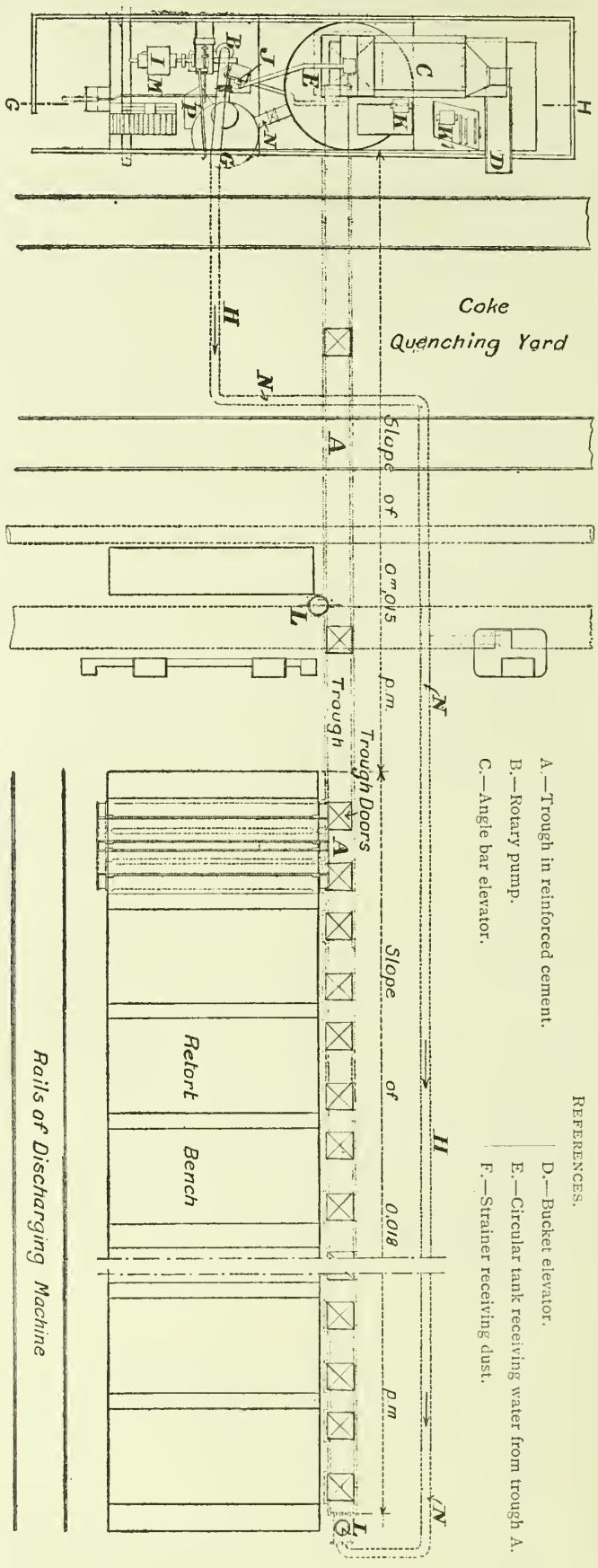


Fig. 4.—Plan of a Water-Jet Hot-Coke Conveyor at La Villette Gas-Works, Paris.

bucket filled with hot coke was not desirable from the point of view of safety.

Another method tried was that of flat trucks moving parallel to the retorts being discharged. Outside the house, the coke was quenched in a water-tower, as the coke was being taken to an elevator which filled the waggons for the coke-breaking plant. The working of the trucks was complicated, more particularly in moving them in unison with the discharging of the retorts.

A movable quenching elevator of large capacity was also experimented with.* It received the coke direct from the retorts, and delivered it into the railway trucks, which took it to the coke-assorting plant. The coke was quenched while still in the elevator.

Lastly, at the Vaugirard Gas-Works, a quenching-box or hopper was arranged in front of a bench of retorts, as shown in fig. 3. The coke fell by gravity into this box, in which (it being shut) the coke was sprayed, and left for some moments in the steam-laden atmosphere. In vaporizing the excess of water, the coke was cooled. The quenching-box, indeed, was in substitution of spreading out the coke in the yard. By this arrangement, 210 kilos. (say 4 cwt.) of coke are quenched with 76 litres (16¾ gallons) of water with a stay of three minutes in the quenching-box. Remaining there for eight minutes, 60 litres, or about 13 gallons, of water are enough. The same amount of coke, if quenched in the open air, would require about 120 litres (nearly 26½ gallons) of water. The coke obtained is very dry, big, and of good appearance; but the arrangement necessitates a retort-house of several floors, so as to place the hoppers underneath. The system is high in first cost and in upkeep.

These different trials showed the possibility of improving the methods of conveying hot coke, its quenching, and loading into waggons, but not one of them solved the question practically and economically.

Quenching and Conveying by a Stream of Water.

Taking up an idea put out thirty years ago by M. Arson, it was thought that a strong stream of water might be utilized for conveying the coke to outside the retort-house, and also quenching it. An installation of this kind has just been finished, and is now in operation at La Villette works on a bench of eight beds, each of seven "through" retorts. Figs. 4 and 5, with the explanatory list of references accompanying them, will enable the general lines of the installation to be followed. There is a reinforced cement trough, A, 46 metres (151 feet) long, placed on the opposite side of the bench to the stoking machinery. This trough has a slope of 18 mm. per 1000 mm. along the front of the bench, and 15 mm. for the remainder. Inside the retort-house, the top of the trough is covered with sheet iron; doors being arranged in it on the centre lines of the retorts. The coke falling through these doors from the retorts is rapidly carried by the stream of water along the trough, and deposited in the hopper of a large elevator with angle bars C, on which it is completely quenched by a spray. Then the buckets of the elevator D take the coke and fill waggons which go to the breaking and sorting plant. The elevators C D are driven by special motors K, K^1. The water, after having been used for conveying the coke, falls into a round tank, E, of about 27 cubic metres (953 cubic feet) capacity. In it is a conical strainer, F, which collects all the dust formed. This is emptied by a special pump J. The water thus strained goes into a second reservoir G, 12 cubic metres (424 cubic feet) in capacity, from which it is returned by a rotary pump B, through the piping H into the trough A. The same water, which is continuously in motion, thus serves for quenching and conveying the coke from all the retorts of the bench. Quenching vaporizes a certain amount of water; and this is made up by adding water to the tank G from the works' water-main M. Two chimneys L are placed, one at each end of the trough, for carrying off the steam produced by quenching.

The quantity of water sent into the trough varies according to the speed of the pump B. This can deliver 450 cubic metres per hour. It is directly driven by an electric motor I, of 25 H.P. at 120 volts. The forcing height between the water level in the tanks and the highest point of the main is 2·22 metres (7 ft. 3½ in.). The speed of the water in the trough at the moment of discharging the retorts is about 2 metres (say, 6 ft. 6 in.) a second. The travelling speed of a De Brouwer conveyor does not exceed 200 to 300 mm. (8 to 12 inches).

When the coke falls into the trough, it is kept on the surface of the water by the phenomenon of calefaction. Being almost carried by the stream, it reaches the elevator C, but incompletely quenched. By the spraying which takes place on the elevator, it is possible to regulate the amount of water contained by the coke. It is to be observed that the mechanical arrangements adopted in this trial at La Villette are not definite; in fact, various appliances which were already on the works were utilized as well as possible. In any case, the system does away with large coke-drying yards; and as none of the apparatus comes into contact with incandescent coke, the cost of upkeep should not be very great. Such a system is capable of numerous applications. Among them is that of vertical retorts, with which the taking away of hot coke, arriving in bulk by successive strokes, is one of the most difficult inconveniences to be overcome.

In conclusion, it is said that the water-jet hot-coke conveyor solves in a very happy way the problem of manipulating large masses of hot coke, quenching it, and then conveying it to other parts of a coke-plant; and that the results obtained reflect very great credit on the engineers and their assistants who have contributed to it.

* See "Journal," Dec. 16, 1902 (Vol. LXXX., p. 1631).

THE "WILD" FLICKER PHOTOMETER.

Mr. Lancelot W. Wild calls attention to a flicker photometer for which he claims many advantages—among others, its perfect freedom from angularity errors, complete reversibility, great sensitiveness, minimum of fatigue to the eye, perfect shielding from strong light, and that all parts of the disc are the same distance from the lights.

In the course of his description of it, Mr. Wild says the photometer consists of a thin circular disc of white material revolving on its centre. The disc is divided into two equal portions—the one opaque and reflecting, the other translucent and diffusing—as shown in fig. 1. The two lights under comparison illuminate the opaque and translucent halves of the disc respectively. The disc is viewed by the agency of a mirror and telescope, as shown in fig. 2. As the disc revolves, the eye of the observer sees first a portion of the reflecting half of the disc and then a portion of the

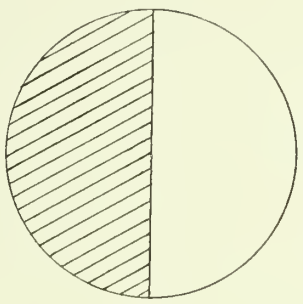


Fig. 1.

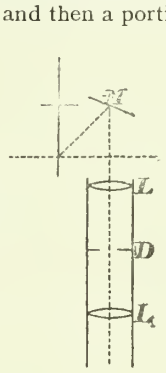


Fig. 2.

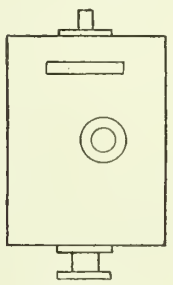


Fig. 3.

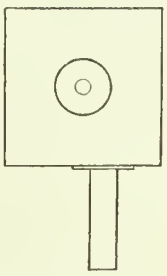


Fig. 4.

translucent half alternately, and in quick succession. If the two halves are not equally illuminated, a distinct flicker is observed every time the dividing line between them crosses the field of vision. This flicker totally disappears when they are equally illuminated. Inside the telescope is a diaphragm; and lenses are so arranged that the diaphragm is in focus when the disc is in focus. The eye is naturally focussed on the diaphragm, and is thus automatically focussed upon the revolving disc. This arrangement it is said reduces the fatigue to the eye to a minimum, and adds greatly to the sensitiveness of the instrument.

The disc being normally perpendicular to the rays of light falling upon it, a small deviation of the angle of the rays produces no measurable change in the illumination of either portion. In a photometer of the wedge type, or, in fact, in any form of photometer in which the surfaces to be viewed are inclined in opposite directions, Mr. Wild points out that the change of illumination due to a small deviation of the angle of incidence is very considerable, and gives rise to large errors in practice.

When the photometer is used with a secondary or intermediate comparison lamp, a single set of readings gives the correct ratio of illuminating power of the lights under comparison. If, however, it is required to compare two lights directly (without bringing in an intermediate or secondary standard), then two sets of readings must be made—the photometer being reversed before the second set is taken. The mean of the two sets gives the correct ratio between the lights under comparison. The reversal is effected by simply lifting the photometer box off its support, and turning it over. This reverses the disc, and the telescope at the same time, and is equivalent to reversing the lights.

The disc is driven by a small electric motor, which can be regulated to a nicety by means of a resistance. The motor runs on the current from a single accumulator or dry battery, or it can be run from the mains, whether direct or alternating current, in series with one or two lamps. In the former case there is needed an adjustable resistance in series with the motor, and in the latter case in shunt with it.

The disc is placed in the centre of a box, 6 inches long, with 2-inch holes either end, through which the light enters. It is, therefore, completely shielded from stray rays of light, except in

the direction of the lamps under test. The room can therefore be illuminated by lights overhead, so that the scale can be easily read, as well as any other instruments.

With this photometer lights of different colours can, it is claimed, be compared almost as easily and as accurately as lights of the same colour. The greater the difference in colour between the lights, however, the higher must be the speed of the motor.

The discs are very thin (less than $\frac{1}{16}$-inch), and, being perpendicular to the rays, there is said to be no residual flicker, after the best balance has been obtained, due to different parts being different distances from the lights. This, of course, increases the sensitiveness of the instrument. But though the disc is so thin, it yet runs dead-true—a result obtained by running it between guides fixed in close proximity to the part in the field of view.

Fig. 3 shows diagrammatically a front view of the photometer; and fig. 4 a plan.

EXPLOSIONS IN ELECTRIC LIGHT CULVERTS.

An Unsuspected Cause.

In the course of a paper read before the Liverpool Section of the Society of Chemical Industry by Dr. H. Bassett, in which he described an interesting case of soil electrolysis, he cited some facts which may account for some of the explosions in street-boxes which are attributed to escapes of gas. The following are the portions of the paper, extracted from the Society's "Journal," specially bearing upon this subject.

Now that electricity is so largely used for lighting and power purposes, and wires conveying the current traverse the ground, especially in towns, in all directions, the effects of wandering earth currents, due to leaks from the wires, and earth returns on tramway systems, occasionally attract attention. These earth currents usually manifest themselves by causing the corrosion of metal objects, such as pipes, tramway rails, &c., placed in the ground. In such cases the object attacked acts as anode; the surrounding earth being the electrolyte. In other cases, where we are dealing with the opposite end—that is to say, the cathode—of the huge voltaic cell thus formed, alkaline deposits are found.

The following case, which was brought to my notice some months ago, may be of interest, as it shows the magnitude of the chemical processes which may be caused by such earth currents. A bad "earth" took place at the Brownlow Hill Workhouse, Liverpool. The leak occurred just under a small roadway, and, though the cable had probably been failing there for some time, the leak was only discovered from the fact that horses became restive at the spot owing to shocks which they received, and which, in fact, one could get by touching certain places. The cable affected was one supplying power to a motor at 460 volts. The current was carried by two thick insulated copper cables—a negative and a positive. These were laid about an inch apart on wooden bridges, in a wooden trough, which was then filled with bitumen; a wooden lid was finally laid over the bitumen. The trough was buried in porous sandstone—the top being about 18 inches below the surface of the ground. The leak had possibly been started by a heavy cart causing a crack in the bitumen, through which water had penetrated to the cable. Only the negative cable (which would be at 230 volts below the potential of the earth) was affected. This cable had been joined at the place where the leak occurred; the join having been bound round (perhaps not very carefully) with waterproofed cloth.

According to the clerk of the works under whose directions the leak was repaired, the material surrounding the leak was still so hot that one could only just touch it, though the current had been switched off for an hour and a half. It was found that the top of the wooden trough had been burnt through, and that a hard substance protruded through the hole thus formed and penetrated to the wire. This substance was so hard that it had to be removed with cold-chisel and hammer; and the workmen, to their surprise, caused big sparks during the operation. They also got rather burnt under the finger nails and on the face by flying chips of the evidently strongly alkaline material. The hard lump had been formed round the negative wire; but the metal was not at all corroded, neither had the insulation of the neighbouring positive wire been affected. The substance removed from the leak was collected, and the Engineer (Mr. A. J. Wilson), who had been much struck by its curious properties, asked me to investigate it.

The pieces brought me were dark grey in colour, very hard, very deliquescent, and strongly alkaline. If treated with a little water, small yellow or lavender flames were formed by bubbles of hydrogen catching fire. The mass evidently contained free alkali metal—in fact, on breaking a piece of the hard substance, the crevices in the interior were found to be filled with bright liquid metallic globules, evidently a liquid alloy of sodium and potassium. When these globules came in contact with water, they ignited, though the viscous alkaline liquid with which the lumps of the grey mass soon become covered on exposure to the air had very little effect on them. Analysis of the hard grey substance showed it to consist chiefly of potassium and sodium hydroxides, with a certain amount of the free metals. There was also a considerable amount of sand from the surrounding sandstone, as well as some silica rendered soluble by the action of the alkali, which must have been nearly fused during the passage of the current. It was quite free from carbonate, sulphate, chloride, &c., neither did it contain any metals other than sodium and potassium. A quantitative analysis gave the following results: KOH, 33·37; NaOH, 32·26; K, liquid alloy, 1; Na, liquid alloy, 0·80; soluble silica, 4·80; sand and earthy matter, 26·36; bitumen and water (by difference), 1·41. The composition of the alloy, as calculated from the above analysis, is 55·6 per cent. potassium and 44·4 per cent. sodium.

The formation of alkali by the electrolysis of the salts dissolved in surface water is, of course, not very surprising; but the quantity formed in the present case is rather astonishing when it is considered what a very small amount of potassium and sodium salts are present in soils. I had in my possession pieces of the alkaline mixture weighing in all 570 grammes; while from what I was told probably not less than 1000 grammes had been formed altogether. The surrounding bitumen for a short distance was also more or less impregnated with alkali. If the leak had not been discovered, but had been allowed to continue, the alkali would have eventually destroyed the insulation of the neighbouring positive wire, and have caused a short-circuit.

The alkali was, of course, formed by the potassium and sodium first liberated by the electrolysis reacting with water. This must have caused the evolution of a large amount of hydrogen. If this gas had been evolved in any position in which it could have accumulated and have got mixed with air, a violent explosion could quite easily have been caused, either by a light being brought near or simply by a globule of the liquid sodium-potassium alloy coming in contact with water and causing a spark. Many of the explosions in connection with electric light mains, usually attributed to accumulations of coal gas, are very possibly in reality due to hydrogen formed by electrolysis—a suggestion which was first put forward by Mr. Foulger at the Board of Trade inquiry into the explosion which occurred in the conduit of an electric light main in the Euston Road, London, on Dec. 29, 1894.*

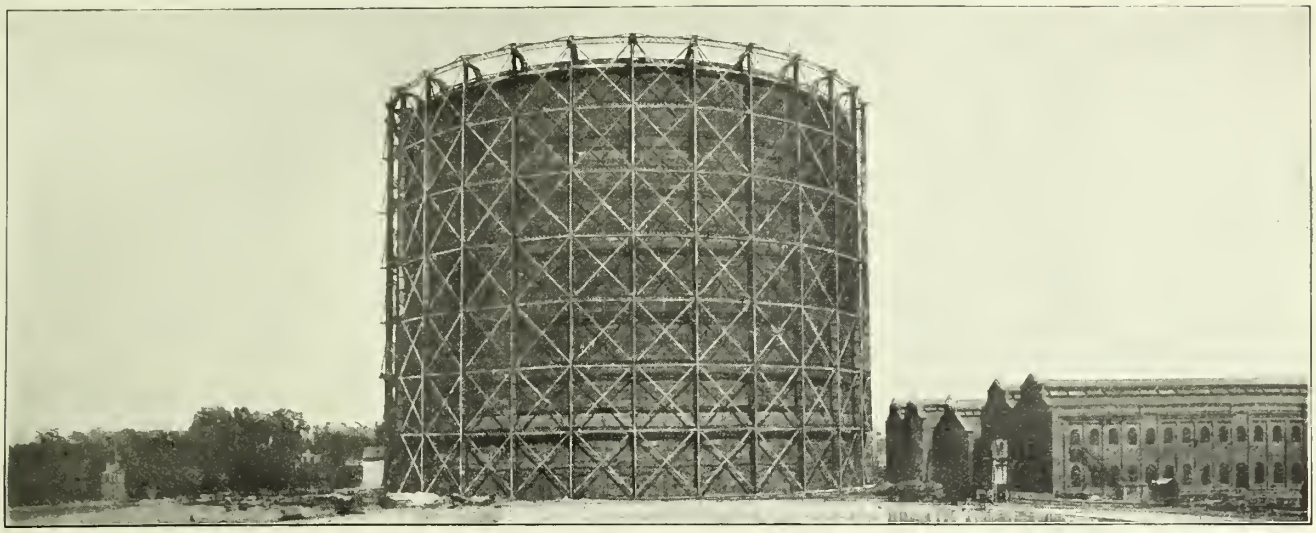
When I mentioned the above case of electrolysis to Professor Marchant, he told me he had recently been having some trouble with some of the switches on the basement walls of the electro-technical buildings of the University of Liverpool. White efflorescences had been forming on these and causing trouble. Professor Marchant gave me some of the efflorescence from one of the switches, and an examination showed that it was simply a mixture of 42·66 per cent. of potassium carbonate and 12·02 per cent. of sodium carbonate, together with water and a small quantity of alumina and silica. It was only the switches on the negative wires that were thus affected. It is plain that moisture had crept through the walls from the outside soil, and finally, on reaching the switch, electrolysis of the dissolved salts had occurred. Potassium and sodium hydroxides had thus been slowly formed, and been carbonated by the action of the atmospheric carbon dioxide. The formation of this efflorescence had been noticed for about two months, and by the end of that time it had become so bad that the switch had to be removed and replaced by a new one.

It is well known that the insulation of a positively charged wire tends to improve; while that of a negatively charged one nearly always deteriorates. This is due to the phenomenon of "electric endosmose," which drives the moisture (or electrolyte) away from the positive wire and towards the negative wire. It appears that on account of this "electric endosmose" about 99 per cent. of the faults which occur on direct-current networks occur on the negative wire. At all negative faults alkaline deposits or solutions are formed; and though it is known that these usually contain potash and soda, in only one or two cases do careful analyses of the products appear to have been made. In certain rare instances also the formation of free alkali metal has been observed.

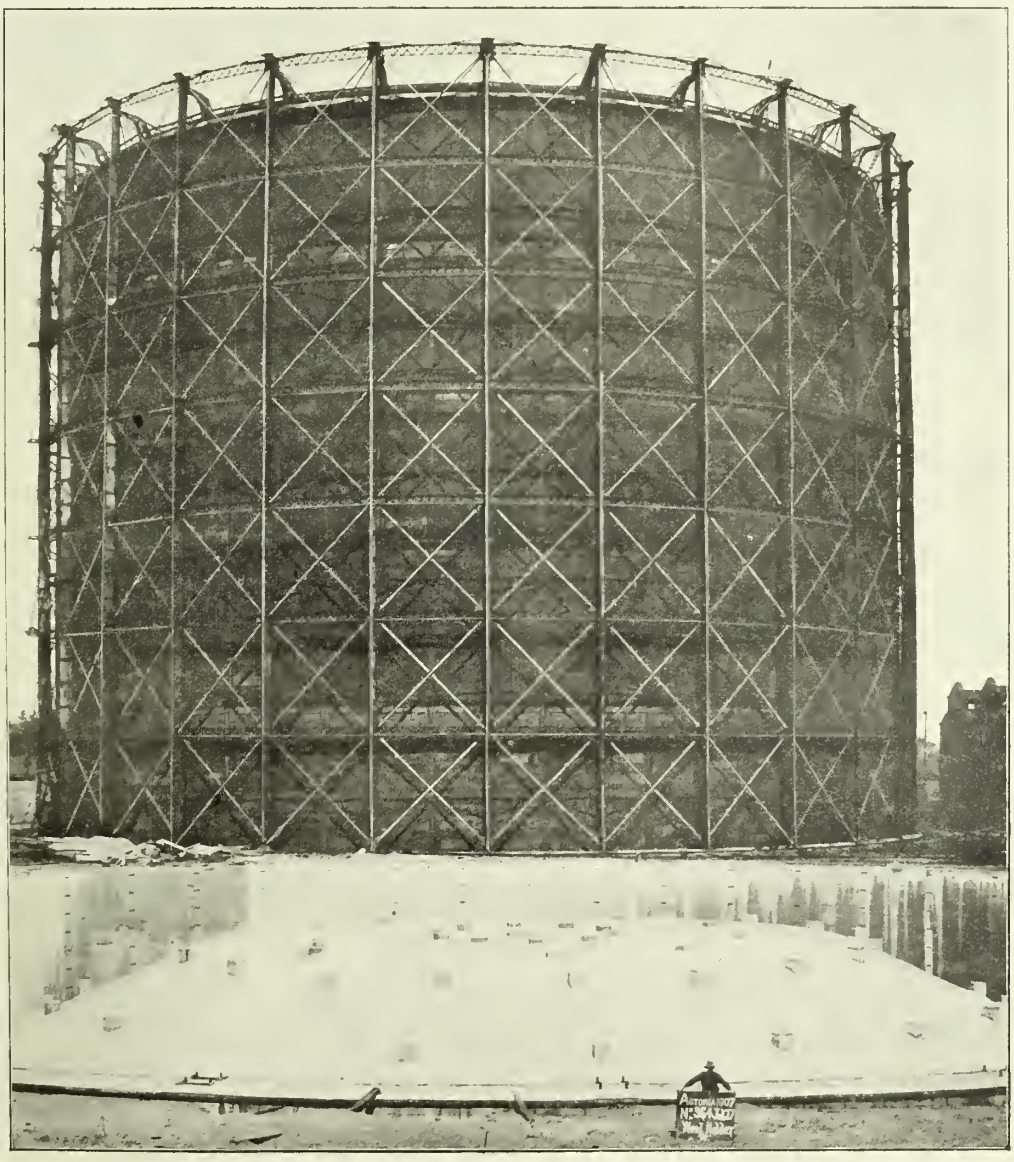
The first record of such a case that I have been able to find is in a letter to the "Electrical World" of July 6, 1889, in which an account of an "earth" in Boston (U.S.A.) is given. The "earth" in many respects was similar to the one recorded in the present note, for the cable affected was embedded in bitumen, and a hard lump was found at the fault, which flashed when wetted. Another case of the kind does not appear to have been noticed until 1895. In February of that year a serious explosion occurred in Euston Road in one of the conduits of the St. Pancras electric lighting system. Major Cardew, during his investigation of the affair for the Board of Trade, found incrustations on some of the insulators supporting the bare copper strips by which the current was carried. These incrustations gave sparks with water, and were found to contain free alkali metal, and it is plain that a fluid potassium-sodium alloy had been formed, as the metal is described as occurring in globules almost as fluid as mercury. As a result of Major Cardew's discovery, a Committee was formed to investigate the causes of the formation of these alkaline deposits. When the Committee inspected the St. Pancras mains (not quite at the place where the explosion occurred), they found an incrustation which flamed on treatment with water, but which in this case contained solid (not liquid) alkali metal. In the Committee's report is an analysis of the incrustation found on the cables near where the explosion occurred. It is as follows: Sodium hydroxide, 7·69 per cent.; potassium hydroxide, 4·88 per cent.; sodium carbonate, 34·4 per cent.; potassium carbonate, 52·77 per cent.; and traces of silica, alumina, and lime. Since 1895 numerous cases of alkali metal formation have been noticed; but I have not been able to find any other mention of an occurrence of the fluid alloy, nor any other analysis of the alkaline incrustation.

* See "Journal," Vol. LXV., pp. 133, 326.

THE HOLDER AT THE ASTORIA WORKS OF THE CONSOLIDATED GAS COMPANY OF NEW YORK.



Readers will doubtless remember that in the autumn of 1904 we gave an illustrated description of the new gas-works at Astoria (New York) which were being put up for the Consolidated Gas Company by their Chief Engineer, Mr. W. H. Bradley. That series of pictures was sent to us by Mr. Bradley through Dr. A. H. Elliott, the Engineer-Chemist of the Company, who was then on a visit to this country. In a subsequent issue (Jan. 9, 1906), Mr. Bradley enabled us to give an illustration showing the progress made with the construction of the large gasholder tank at his works; and to-day we complete the series by the reproduction of two photographs of the holder sent by Dr. Elliott. They were taken at the first complete inflation of the holder, which will contain 15 million cubic feet of gas. Its location in regard to the other plant on the works will be seen on reference to the plan of the site which was given in the "Journal" for Oct. 18, 1904 (p. 165); but it may be pointed out that to the right are the purifier-houses of the east and west sides of the new works—each side being complete in itself. The middle building of the five gables to the right is the meter-house. In the horizontal picture our readers will get a complete view of the new east gasholder tank, which is ready to receive the ironwork. Both pictures were taken by Dr. Elliott, who, we think it will be conceded, deserves congratulation on his success; the details of the holder being very clearly shown. It may be mentioned that a section of the new works was brought into use on the 3rd of December last, in quite an informal way, by the charging by Mr. Bradley of the first inclined retorts in a house containing 64 settings of nines. The gas produced in this house was pumped to the Ravenswood works at Long Island City, and sent thence by the East River Tunnel to New York, pending the completion of the holder, which it was expected would be ready by June. The expectation has been fairly well realized. We must once more express our thanks to Mr. Bradley and Dr. Elliott for enabling us to illustrate the interesting engineering features of the magnificent works with which they are both associated.



THE ILLUMINATING POWER, IN ORDINARY AND INCANDESCENT BURNERS, OF COAL GAS, WATER GAS, AND MIXTURES OF THE TWO GASES.

By M. Emile Sainte-Claire Deville.

[Abridged Translation, with Comments, by W. J. Atkinson Butterfield, M.A., F.I.C., of a Communication presented to the Meeting of the International Photometric Committee in Zurich, July 18 to 20.]

The interesting communication which M. Sainte-Claire Deville the Manager of the experimental works of the Paris Gas Company, presented to the recent meetiug of the International Photometric Committee at Zurich is a sequel to a communication which the same author presented to the meeting of that Committee in 1903, and of which an abridged translatiou appeared in the "Journal" at the time (Vol. LXXXIII, pp. 499, 567, 617). Nevertheless it is sufficiently iudependent of the earlier paper to form, apart from the latter, a consecutive and exhaustive report on a large number of investigations which M. Sainte-Claire Deville has carried out with his characteristic thoroughness aud patience. But events in this couutry have moved too quickly for him; and his iuvestigations, iu so far as they relate to English methods of testiug the illuminating power of gas, do not carry him later than the use of Sugg's "London" argand No. 1 buruer, at the rate of consumption requisite for the production of a flame of fixed intensity—viz., 16-candle power. This method bccame obsolete in London when the provisions of the London Gas Act, 1905, came into force ou Jan. 1, 1906, and is already comparatively little used in other parts of the country. Nevertheless, there is much of abiding interest to English readers in M. Sainte-Claire Deville's investigations; aud the idea of prepariug an abridged reudering into Euglish of his communication has appealed to the trauslator, in that it will afford him an opportuuity of presenting, by way of comments or addenda, a number of facts within his knowledge which may help to conuect the observations of the author with the work of the English gas photometrician past and present. In order to avoid confusion, the translator's comments and notes will be distinguished from M. Sainte-Claire Deville's work by being put within brackets, or as foot-notes or separate paragraphs, as may be most convenient in each instance.

It seems desirable to point out that M. Sainte-Claire Deville incidentally remarks in a foot-note that he wishes it to be understood that his criticisms of customary photometric methods refer to them as scientific means of measuring the illuminating power of all gases which give luminous flames. As empirical checks intended only to determine whether a gas does or does not comply with certain closely defined aud restricted conditions, he thinks they may be excellent. Unfortunately, the methods devised for the latter official purposes have been everywhere adopted for theoretical investigations on the variations of the illuminating power of gases. It is in respect of this extension of their application, which was not contemplated by their devisers, that he criticizes them.

First Memorandum (Dated Dec. 20, 1904).

THE ILLUMINATING POWER OF COAL GAS IN DIFFERENT COUNTRIES.

Introduction.

The President of the International Committee on Photometry has drawn the author's attention to the usefulness of an empirical table showing the agreement which subsists between the official standards of illuminating gas in France, England, and Germany. By official standards are understood: In France, the illuminating power defined by Dumas aud Regnault, according to the agreement made in 1861 between the City of Paris and the Paris Gas Company. In England, the illnminating power defined in the Notification of the Metropolitan Gas Referees for the summer of 1899 (the mode of determining the illuminating power of gas which this definition involves was, in fact, first prescribed by the Gas Referees in their "Notification" dated May, 1898. By it, the gas had to be burnt in the standard testing burner—Sugg's London argand No. 1—at such a rate that a light of fixed intensity, viz., 16-candle power, should thereby be afforded). In Germany, the illnminating power defined by the Photometric Committee of the German Association of Gas and Water Engineers in June, 1898 (*vide* "Journal," Vol. LXXIII.).

It must be recognized at the outset that such a table can ouly show the agreement with approximate accuracy. Thus, if a gas tested in France and Germany has a valuation of 104 litres in France, and of 15 Hefners in Germany, it would not be right to conclude that another gas, having a different composition, which had the same valuation of 104 litres in France, would necessarily give the valuation of 15 Hefners in Germauy. This depends on the fact that variations in the composition of the gas may not modify in the same degree the consumption of the (French standard) bengel burner for the intensity of one carcel on the one hand, and the intensity of the (German standard) Elster burner consuming 150 litres (5·3 cubic feet) per hour on the other hand. The numerical data relating to illumiuating power of one country can be accurately translated; and even different standards of light are no obstacle, provided their relative values are known. But it is absolutely essential that the burner in which the gas is consumed for testing should be precisely the same everywhere, and should be used in the same manner. The suggested table of approximate equivalents, none the less, has a certain interest; and the author regrets that his manifold duties have not allowed him to carry out the programme of tests which he had arranged with a view to drawing it up. He has, however, thought that it would probably be useful to submit some extracts from old unpnblished notes, dealing with the matter from an interesting, though slightly different, standpoint.

The notes start with an investigation in 1893 of the relation of Parisian illuminating power to the old English illuminating power. The tests theu made showed that the percentage divergence between the illuminating powers of two particular gases is about twice as great if the valuation is made in English candles as it is if the valuation is in terms of the consumption for one carcel. This difference is enough to make all theoretical and practical researches on variations of illuminating power and their causes which have been made in one of the two countries incomprehensible and not capable of verification in the other.

This being recognized, the next question is which of these two "illuminating powers" is the more natural, or which ascribes to different gases values most in accord with their relative richness in hydrocarbons or their calorific power? The reply to this question is suggested in the conclusions of a general investigation on combustion in gas-burners made in 1880 to 1883. This investigation showed that it was easy, by carefully choosiug an argand burner and supplying it with air artificially, to make sure of securing the maximum illuminating duty which a gas was capable of yielding, either for a stipulated consumption or a stipulated intensity. It is evident that this maximum duty, determined under identical conditions for all gases, cau be considered to be the true or theoretical illumiuating power. Now comparative measurements have demonstrated that while the theoretical illuminating power naturally always has a higher absolute value than the Parisian illuminating power, their variations are of the same relative order. Both are nearly proportional to the ratio of the air required for combustion to the gas in the case of maximum duty. These tests consequently displayed the superiority of the Dumas and Regnault method over the old English method.

What has to be said in this "First Memorandum" will be comprised in four sections and an appendix. Section I. refers to the comparison of the Parisian with the old English "illuminating power." Section II. defines absolute illuminating power, and describes the practical method of determining it. An appendix to this section quotes a paper prepared in 1883 on "A general study of combustion in gas-burners." Section III. gives a comparison between the absolute illuminating power, the Parisiau illuminating power and the calorific power of the gas, and the proportion of air required for combustion in the case of maximum intensity of light. Section IV. comprises the author's couclusions.

Section I.—*Comparison of the Parisian with the Old English Illuminating Power.*

The intensity of the light afforded by a Sugg's "London" argand burner No. 1, consuming 5 cubic feet per hour, was measured in carcels, and translated into English candles by multiplying by the co-efficient 9·6. (This co-efficient, according to the resolution of the International Committee at this year's meeting, should be 9·8—See *ante*, p. 301.) There were 48 diffcreut samples of gas so tested, the chimney used being 1⅞ inches diameter and 6 inches long; while 32 other samples were tested with the smaller chimney 42 mm. (1·65 inches—doubtless should be 1⅞ inches) in diameter and 150 mm. (5·9 inches—doubtless should be 6 inches) long. The two series of tests gave aualogous results, from the present point of view; and only the first series will therefore be now used.

It has already been pointed out that two gases of different composition may both have the same illuminating power according to the Paris system but differeut according to the English. The discrepancy may not be very great, but is greater than the possible error of observation. As a result, on plotting out the values for the 48 gases, the diagram shows an irregular patch instead of a line; but by sorting the values into six groups and taking the

means, the latter give almost exactly a straight line, which is the axis of the patch. From this line, an equation may be deduced by means of which the illuminating power of a gas, stated in English candles, may be calculated into terms of the consumption for one carcel, and *vice versâ*. Thus a table showing the approximate relation between the values may be prepared. The author is not at liberty to publish the actual values in such a table of the six groups of gases; but taking as the basis of comparison an average gas of the value of 105 litres according to the Paris method, then the divergences of the values under both systems of valuation for the different series of gases are as follows: (The differences are here stated in percentages below or above the value, according to the same system, of the average gas which is taken as the basis of comparison. A rather different method of stating the differences is used in the original.)

TABLE I.

—	Paris Valuation.	English Valuation.
Gas A, very poor	−10·6	−22·0
,, B, poor	− 5·8	−10·9
,, C, moderate	− 1·8	− 3·5
Average gas	—	—
Gas D, good	+ 1·2	+ 3·1
,, E, rich	+ 3·9	+ 8·1
,, F, very rich	+10·9	+21·6

The inconvenience which may arise from this difference in the valuation may be shown by an instance. Suppose an English gas engineer investigates in London the effect of some alteration in manufacturing conditions on the illuminating power of the gas produced, and finds that the alteration reduces the gas from grade E to grade C. The reduction is therefore from 100 + 8·1, to 100 − 3·5, or 11·6 on 108·1, or 10·8 per cent. A French engineer, astonished at the result, makes the investigation and finds the reduction to be from 100 + 3·9 to 100 − 1·8, or 5·7 on 103·9, or 5·48 per cent. only.

The opinion the two engineers form of one another, in consequence, may be imagined.

The situation was ameliorated, in so far as French and English conditions were concerned, by the alteration in 1899 in the mode of testing gas in London (*i.e.*, by the change from burning the gas at the fixed rate of 5 cubic feet per hour to burning it at the rate necessary to produce a flame of fixed intensity actually introduced by the Notification of the Gas Referees, dated May, 1898. The latter procedure continued valid in London up to Dec. 31, 1905. In 1906, the fixed rate of burning of 5 cubic feet per hour was reverted to, but another burner was introduced—Sugg's "London" argand No. 1, which had been prescribed by the Gas Referees from March 31, 1870, to the end of 1905, being superseded by Carpenter's "Metropolitan" argand No. 2.) But the German method of testiug (*i.e.*, burning the gas at the fixed rate of 150 litres, or 5·3 cubic feet, per hour) continues on the lines of the old English system. Any tables of the relations subsisting between measurements made under different national systems can only afford a partial solution of the difficulty, for such tables prepared in London would differ from similar tables prepared in Paris, owing to the differences in the gas made in the two cities (*i.e.*, the presence of considerable quantities of carburetted water gas in much of the gas supplied in London). Confusion must prevail until the same testing burner is used in the same manner in both countries. Perhaps, however, it would be better to disregard the artificial quality known as "illuminating power,' because the calorific power fully suffices for estimating the value of a gas from every standpoint.

SECTION II.—*Definition and Measurement of Absolute Illuminating Power.*

The least volume of air over and above the volume necessary for the combustion of the gas, which must pass through an argand burner in order to prevent the flame smoking, is called by the author the "obligatory excess" for that burner. It is very small for Sugg's "London" argand No. 1 burner, with chimney $1\frac{5}{8}$ inches in diameter and 6 inches long (in original 42 mm. by 150 mm.). One volume of gas of average composition requires 5·5 volumes of air for complete combustion, and that burner takes 6 volumes; so that the obligatory excess is only 0·5 volume. Let all the air consumed be supplied from a gasholder through a meter and desiccating chamber, so that it may be measured, and the burner be set up on a photometer. Open the air-supply tap freely, and then the gas-tap, and light the burner. By manipulating the two taps, the light afforded may quickly be made to equal 1 carcel, and then the air supply can neither be increased nor reduced without lowering the intensity of the light from the burner. So regulated, the flame does not flare; but it becomes smoky if the air supply is reduced by ever so little. Thus the maximum illuminating duty coincides with the minimum supply of air. Once the supply has been regulated, the consumptions of gas and air are observed and expressed in terms of the consumption per carcel, and its reciprocal—viz., the candle-power per 100 litres (3·53 cubic feet) of gas consumed per hour (or say, candle power per cubic foot). The latter value is a measure of the absolute illuminating power of the gas.

The ratio $\frac{\text{air}}{\text{gas}}$ or the volume of dry air consumed per 100 volumes of humid gas is an expression inherent to the gas tested, of which the variations in relation to the illuminating power have to be investigated. The volume of aqueous vapour which saturates the air at the temperature of the meter is deducted from the gross volume of air; so that the ratio is that of dry air to moist gas, both at the same temperature and pressure. These are the conditions under which the "absolute illuminating power" has been measured.

SECTION III.—*Comparison between the Absolute, the Paris, and the English Illuminating Powers, the Calorific Power, and the Proportion of Air Required for the Combustion of Gas.*

Comparative measurements were made in the latter part of 1893, on 46 samples of coal gas, of (1) the statutory Parisian illuminating power, (2) the absolute illuminating power, as defined, and the proportion of air for combustion, and (3) the gross calorific power, determined by the Mahler bomb. The specific gravity and composition of the samples were also determined, but are not dealt with here for the sake of brevity. The results have been grouped in eight classes, each comprising gases similar in character and quality. The results are stated in relation to the value, taken as 100, of statutory Paris gas (105 litres per hour per carcel) according to each mode of testing. The results are shown in Table II., to which a column has been added showing the old English illuminating power, calculated from the formula referred to in the introduction.

TABLE II.

Group.	Number and Nature of Samples of Gas.	Calorific Power.	Parisian Illuminating Power.	Absolute Illuminating Power.		Old English Illuminating Power (by Calculation).
				Light per 100 Volumes.	Proportion of Air.	
I.	1 from last stage of carbonization	− 33·2 per cent.	Nil	Nil	− 41·3 per cent.	—
II.	4 very poor, from third hour of carbonization.	− 11·2 ,,	− 29·3 per cent.	− 30·7 per cent.	− 21·9 ,,	—
III.	14 poor	− 4·6 ,,	− 10·6 ,,	− 10·4 ,,	− 5·5 ,,	− 22 1 per cent.
IV.	7 moderate	− 1·4 ,,	− 2·9 ,,	− 2·1 ,,	− 1·7 ,,	− 6·0 ,,
—	Statutory Paris gas = 100	—	—	—	—	—
V.	10 good	+ 0·6 ,,	+ 2·2 ,,	+ 1·0 ,,	+ 1·4 ,,	+ 4·5 ,,
VI.	7 very good	+ 5·2 ,,	+ 9·2 ,,	+ 5·9 ,,	+ 7·1 ,,	+ 19·0 ,,
VII.	2 very rich, from first hour of carbonization	+ 29·1 ,,	+ 42·9 ,,	+ 34·5 ,,	+ 44·5 ,,	—
VIII.	1 extra rich, from first hour of cannel	+ 81·6 ,,	+ 110·5 ,,	+ 99·8 ,,	+ 179·3 ,,	—

Taking up the standpoint that the absolute illuminating power is the typical or standard illuminating power, then the photometric method which will show a proper and true relation between the lighting values of the different gases ought to give figures closely approximating to those for the absolute illuminating power. It is easy to see that in this respect the Parisian method is far superior to the old English method. This is explicable by reference to the behaviour of the two standard burners and their modes of use. The English Sugg burner has a very slight obligatory excess of air, and is therefore very sensitive to the further or contingent excess. When a very rich gas is consumed in it at the rate of 5 cubic feet per hour, the volume of air brought in contact with the gas by the draught of the chimney is exactly sufficient. The gas then burns without any contingent excess of air—that is to say, under the conditions under which it gives the best return. On the other hand, if a poor gas requiring less air is consumed at the same rate, the quantity of air drawn in by the chimney is as great as before, and furnishes a considerable contingent excess which destroys part of the illuminating power. Thus while rich gases are tested almost under conditions of maximum duty, poor gases are tested under relatively bad and inferior conditions, and are unduly depreciated. In the French method, however, the bengel burner has a considerable obligatory excess of air, and is consequently less sensitive than the Sugg burner to variations in the contingent excess. But, in particular, the contingent excess is not necessarily greater for poor gases, because the ratio of air to gas diminishes through the consumption of gas being increased in order to give the fixed light of 1 carcel. These considerations must have weighed with the English scientists who established in the year 1899 (actually in May, 1898) the

newer mode of testing which rests on the same principle as the French method.

Within moderate limits, such as those covering ordinary qualities of coal gas, the calorific power and the proportion of air to gas pretty closely follow the variations in the absolute illuminating power. But they naturally continue to have considerable values after the gas has ceased to have any "illuminating power."

The author is one of those who believes that in a few years' time the calorimeter will completely take the place of the photometer as an apparatus for valuing and controlling the quality of gas. In his opinion, therefore, it is no longer of use to try to improve and co-ordinate methods for determining the illuminating power of gas-flames. But if the International Photometric Committee think otherwise, he would suggest that they should direct their attention to giving an international definition of the illuminating power of gas-flames based on absolute illuminating power.

Conclusions (of the First Memorandum).

I.—Different illuminating gases, and coal gas in particular, are mixtures in an infinite variety of proportions of a large number of simple or compound constituents. The specific gravity, calorific power, and content of hydrogen, carbon, oxygen, nitrogen, and sulphur, can be measured with precision. They form specific properties, defined in the same terms in all countries. But the case of the illuminating power of the flames produced by the gases is different. In principle, the illuminating power of the flame or the lighting duty is the ratio of the intensity to the consumption per hour, and the units by which it may be valued can be reduced one to the other. But the ratio of intensity to consumption varies greatly for the same gas according to the manner in which it is burnt. Thus, in order to define the illuminating power of gas, the mode of combustion must first be settled.

II.—The mode of combustion acquires importance because there is no common measure between illuminating powers expressed according to different modes of combustion. For instance, two gases of the same illuminating power by the old English method may have illuminating powers differing one from the other according to the Paris method. The differences between the methods rest solely on the method of combustion in the testing burner and on the excess of air with which the gas is consumed in that burner.

III.—Experience proves that with all gases burners can be made of almost equal efficiency under these conditions: (1) Reducing the excess of air to its minimum—*i.e.*, to the proportion which is absolutely necessary to prevent the flame becoming smoky—and (2) choosing for effecting such combustion a burner in which the gas may be burnt without smoking with a proportion of air very close to that theoretically requisite for complete combustion. Experience further proves that the lighting duty of the gas thus burnt on the point of smoking is the highest duty which is compatible with the given power of the burner.

IV.—It is quite easy to attain this mode of combustion with the maximum duty by using an argand burner with artificial feed of air. The maximum duty or absolute illuminating power is very nearly what may be called the specific illuminating power of a gas. Other methods of valuing gas may be judged by reference to it as a standard.

V.—It has been ascertained that though the absolute illuminating power is higher than the Parisian illuminating power (by 18 to 20 per cent. for gas of average quality), the divergence between the two methods is not far different for the worst and for the best gas. Thus the Paris method justly assesses the relative values of different gases, and is therefore good. The old English method, on the other hand, enormously favours rich gases, and depreciates poor gases. It is more than likely that the method of the Committee of German gas engineers has the same defect. On the contrary, the newer English method presents more or less the same advantages as the Dumas and Regnault method, the principles of which it follows.

VI.—If it were still 1880, the author would strongly recommend the universal adoption of the measurement of absolute illuminating power, or a method based on the same principle. But on the eve of 1905, he finds thousands of incandescent gas-burners in the streets and shops of Paris and only half-a-score of flat-flame burners, and still fewer of the argand or Wenham type. He is convinced thereby that the International Photometric Committee should concentrate their efforts on consigning to the grave the idea of the illuminating power of gas-flames. The expression of absolute illuminating power has come too late to be of service.

VII.—It is evident that if the measurement of the illuminating power of flames is discarded, the determination of the calorific power of gas will be substituted for it as a criterion of the value of gas. It is certain that for almost all uses of gas other than lighting, calorific power is the essential gauge of value, as it is a measure of the energy contained in unit volume of the gas. The author endeavoured to show in his communication to the first session of the International Committee* that the lighting value of coal gas in an incandescent burner is very nearly proportional to the calorific power of the gas. There has still to be investigated whether a similar relation obtains with non-luminous gases, of which water gas is typical; and the author has such an investigation in hand. (It is reported in the sequel.) If calorific power fails to answer as a criterion of the value of gas for incandescent lighting, that value can then only be determined by an entirely new direct method.

VIII.—A method of this kind has been used by the author in investigating the relation between the lighting value in incandescent burners and the calorific power of coal gas. This method applies the principle on which the determination of absolute illuminating power was based. (It is described in the sequel.)

The use of burners with an artificial air-feed is highly instructive, and the author cannot too strongly recommend them to experimentalists on these matters.

[This is the conclusion of the author's first memorandum proper, though there is an appendix to Section II. in which a summary is given of five reports which he prepared betwen May, 1880, and July, 1883, dealing with the action of flat-flame and argand burners. It seems unnecessary at present to give further particulars of the contents of this appendix. In referring to the distinction which the author makes between the "obligatory" and the "contingent" excess of air supplied to argand burners, some explanatory matter from this appendix has already, for convenience, been incorporated in the foregoing summary of the contents of the memorandum proper.]

(To be continued.)

* See "Journal," Vol. LXXXIII., pp. 499, 567, 617.

PRIMARY, SECONDARY, AND WORKING STANDARDS OF LIGHT.

By Edward P. Hyde.

[A Paper read before the Illuminating Engineering Society at their Boston Meeting.]

It is not my intention in this paper to present to you a history of primary standards of light, or to make a study of the relative merits of the various standards in use at present. It is my purpose rather to ask your consideration of a few very practical questions in connection with the relationship of primary, secondary, and working standards of light. By a "primary" standard is meant any standard that can be set up from written specifications—such as the Violle platinum standard, the Hefner lamp, or the Vernon Harcourt pentane lamp. By a "secondary" standard is meant a standard which, though not reproducible, will remain constant after having once been calibrated—the well-seasoned incandescent lamp is the best example of this. By a "working" standard is meant any lamp that is used as a standard in ordinary photometric measurements. It may be a secondary standard or even a primary one; but it is not necessarily either. Though the three classes of standards are quite separate in principle, they overlap in practice.

There is one quality which all standards must possess in common—they must have a suitable colour. This requirement is very indefinite; but it must needs be so. We cannot specify the actual spectral distribution; but we can exclude monochromatic sources. In other words, we can immediately eliminate some sources as being impracticable, whereas we cannot assign values relative to those which fall within the wide range of acceptability. In addition to this common property, there are special properties which each class of standards must possess.

A primary standard is good or bad accordingly as it is or is not reproducible. Its fitness as a primary standard depends upon the degree of accuracy with which it can be reproduced. It is not necessary that it should remain constant over a long period of use; the time at which the measurements are to be made can be specified, as is done in the case of the Violle platinum standard. It is not even necessary that it should be particularly inexpensive or simple, as it is sufficient that it should be set up from time to time in one or several of the various national standardizing laboratories now in existence. The only absolutely necessary qualification of a primary standard is that, in case all the secondary and working standards should be destroyed, the unit could be re-established. Of course, if a lamp can at the same time serve as a primary standard and a secondary or working standard, it is the more valuable. If it is simple and inexpensive, so much the better; but these are not necessary qualities of a primary standard.

In a secondary standard, we desire other qualities. These are best seen by keeping in mind an example—the well-seasoned incandescent lamp. A secondary standard need not be reproducible (we cannot make two incandescent lamps exactly alike); but it must remain constant after having once been calibrated in terms of the primary standard. It should be portable, simple, and inexpensive. Every standardizing laboratory should have secondary standards against which to measure the working standards of lamp manufacturers and testing laboratories.

The working standards should be adapted to the particular kind of testing in which they are to be used. In testing incandescent lamps, we want as working standards other incandescent lamps; in testing gas or oil, we want flame standards. Working standards should be portable, simple, and inexpensive; easy to manipulate; and of suitable intensity. But they need not be

reproducible. Having been standardized in terms of secondary standards, they should remain constant over a reasonably long period before having to be recalibrated or replaced.

With this brief statement of the requirements of primary, secondary, and working standards of light, let us inquire into the present conditions regarding these three classes of standards. First, is there a satisfactory primary standard of light? I think you will all agree with me that there is not. Many such standards have been proposed from time to time; and at present there are three or four such standards in actual use. This last fact in itself indicates that there is no one standard sufficiently superior to the others to warrant its general adoption. And if we look over the tables of relative values of these different standards, and compare the values found at one laboratory with those found at another, or those obtained in recent determinations with those accepted as the best of previous determinations, it is evident that there is an uncertainty in the ratios well beyond the limits of the error of measurement.

The situation with regard to secoudary standards is quite different. It is generally conceded that the well-seasoned incandescent lamp meets every requirement of a secondary standard of light. The objection occasionally raised, that it changes with the time of burning, is not in my opinion as important as the changes which seem to take place at times when the lamp is stored away. A 4-watt per candle lamp, if properly seasoned, will not change appreciably—*i.e.*, more than two or three parts in one thousand in 50 to 75 hours' continuous burning. Since it only requires several minutes to measure an incandescent lamp, the standard lamp could be measured 500 or 1000 times before it would change appreciably in intensity. Since at the Bureau of Standards there are incandescent lamp secondary standards that are only used once or twice a year, it is evident that if only the change in candle power due to burning is to be reckoned with, the unit, in terms of which the secondary standards are expressed, could be maintained constant to within two or three parts in one thousand for several hundred years.

On the other hand, there seem to be much larger changes in the lamps from time to time while the lamps are not burning. Occasionally a lamp develops a bad vacuum; at other times a change in resistance is noticed—indicating probably an altered contact resistance between the filament and the leading-in wires. But apart from these changes in candle power, which are accompanied by changes in the electrical properties of the lamps, and which can probably be explained, there are apparent changes in intensity which are just over the limit of observational error, and for which we can offer no explanation. In determining the relative values of a number of incandescent lamps that have beeu inter-compared before, one of the lamps may seem to be high or low in intensity, with respect to the mean of the remaining lamps, by $\frac{1}{2}$ per cent. or more. I do not mean that a single observer with one set of readings finds the lamp off by that amount—observational error might possibly account for that; but the mean of a number of sets by one obscrver agrees with the mean of a number of sets by another observer, in giving to the lamp a value somewhat different from that which it previously had. In another set of measurements, some time later, the lamp may come back to its original value. Whether these apparent changes are due to slight differences in the conditions of measurement at different times, or whether they are real chauges in the lamps, it would be premature to say at present. They are small, however; and if a number of lamps are used, the mean value should remain sensibly constant over a long period.

The well-seasoned incandescent lamp is also an entirely satisfactory working standard in the photometry of electric lamps; but it is not suitable for use in gas photometry. It requires electric power to operate it, and electrical measuring instruments to control it; and these are usually not available, particularly in small gas plants. But, apart from its inconvenience, it is unsatisfactory. The intensity of a gas-flame is a function of the atmospheric conditions; and it would not be practicable to correct all measurements to standard conditions, as that would involve determinations, not only of water vapour and carbon dioxide, but also of the proportion of oxygen present in the atmosphere. In supplying gas, however, it is desirable for the manufacturer to state that the candle power of the gas furnished under normal atmospheric conditions would be up to the requirement. The way in which to determine this, without actually making the corrections, is to have as a working standard a lamp that is affected by the atmospheric conditions in the same way, and to the same amount, as the gas under test. If the intensity of the standard lamp under normal conditions is known, the candle power of the gas under normal conditions is obtained, immediately, by direct comparison with the standard lamp, independent of the atmospheric condition of the photometer room, provided it is uniform throughout the room.

The consensus of opinion among gas engineers is certainly that the working standard for gas photometry should be a flame standard. There seems to be less unanimity, however, in regard to what flame standard should be used. Candles are still employed to some extent in the United States and abroad; but recently there has been considerable advance both in this country and in England in the adoption of the Harcourt 10-candle power pentane lamp. In Germany the Hefner lamp is used now to a great extent in gas photometry, I believe; and in France the Carcel lamp continues to be used almost exclusively. But although flame standards have been, and still are, used in gas photometry, I do not know of any investigation of the relative influence of atmospheric changes on the gas and the standard lamp. It is scarcely justifiable to assume that the co-efficients are the same for two such flames as the pentane flame and the gas flame, which are controlled in entirely different ways. The pentane lamp is adjusted for flame height, whereas in much of the gas work the flame of the batswing burner is adjusted to a definite rate of consumption of gas by weight. Recently, in co-operation with the United Gas Improvement Company of Philadelphia, the Bureau of Standards made some experiments along this line in one of the Company's gas-testing photometer rooms in Philadelphia. Although these preliminary experiments were not carried far enough to warrant any very definite conclusions, they indicated that the two flames—the pentane and the gas—are affected in the same way, and to approximately the same extent, by changes in the atmosphere. Since differences of 8 or 10 per cent. in the intensity of the standard lamp may readily occur under normal working conditions, it is evident, if results of any accuracy are sought, it is not sufficient that the atmospheric conditions should affect the standard flame and gas-flame in the same direction; at the same time, the coefficients of change for the two should be nearly the same.

Another interesting fact in connection with the working standards in gas photometry is that, with the possible exception of the Carcel lamp (which, I believe, has been calibrated in terms of the Violle standard), all of the lamps used as working standards are at the same time primary standards. In the photometry of electric lamps, the seasoned incandescent lamp soon came to be used as the working standard, since the primary flame standards were not convenient; but in the photometry of gas, since a flame standard was desired, the primary standards came to be used as the working standards. Although this is a logical result, it is questionable whether it is the most satisfactory one.

Is it not possible that a cheap and portable lamp, which would remain constant in intensity after having been calibrated, might be found which would be more convenient and more easily manipulated than the Harcourt pentane lamp, for example? It does not follow that the lamp which best satisfies the requirements of both a primary and a working standard will satisfy the requirements of a working standard alone better than any other lamp. With authoritative testing laboratories available, where secondary standards are maintained, it is no longer necessary that the primary standards should be used in industrial photometry.

I have no such lamp to suggest as a working standard for gas, and it is possible that none can be found; but I think it is well to divorce the functions of the two kinds of standards. Reproducibility is the chief requiremeut for a primary standard, and constancy with burning is only a convenience. With the working standard, reproducibility is of no consequence. The lamp, however, should remain constant while burning, thus maintaining the candle power assigned to it on calibration. If the lamp which is the most reproducible is the most constant and convenient, then use it as a working standard; but do not confine the search for a working standard to those lamps which are reproducible.

The use of a primary standard as a working standard may, however, lead to a confusion of units between the gas and electric industries. This is exemplified by the situation in America at present. Both in the photometry of gas and of electric lamps, the intention was to use the British parliamentary candle. The American Institute of Electrical Engineers recommends obtaining the candle through the Hefner by the use of the ratio one Hefner equals 0·88 candle, which was supposed to be the mean value of the best determinations of that ratio. In gas photometry, the sperm candle (or more generally in recent years the Harcourt pentane lamp) has been used. It is definitely known now that the candle obtained through the pentane lamp does uot bear to the Hefner candle the ratio of 1 to 0·88. From comparisons through electric lamps measured at the National Physical Laboratory in England and at the Physikalische Technische Reichsanstalt in Germany, the above ratio is found to be in error by 2 per cent. From direct comparisons of Hefner and Harcourt pentane lamps, the ratio appears to be in error by 4 or 5 per cent. If, now, both the gas and electric lighting industries adopted the same unit, which could be maintained at a national laboratory, and in terms of which working standards for both gas aud electric lamps could be calibrated, "candle power" would have a single significance throughout the entire country.

The final step would be to agree with other civilized countries as to the value of the unit adopted, so that we might have in photometry, as in most other branches of physical science, an international unit. Although the German unit is so different from the others as to offer considerable difficulty to the realization of this plan, the units of England, France, and the United States are sufficiently close to warrant a compromise. This compromise would not entail the abolition of the present standards; it would merely necessitate assigning to the standards different numerical values. Thus the Carcel would no longer be 9·6 bougies decimales, but 9·5 or 9·4 international candles. Each country could maintain the unit through whatever standards it chose, primary or secondary, but by frequent inter-comparisons among the various countries, the unit would be maintained. Let the search for a suitable primary standard be continued, and may the time soon come when there shall not only be an international unit, but an international standard which shall take rank with the other international standards of modern physical science.

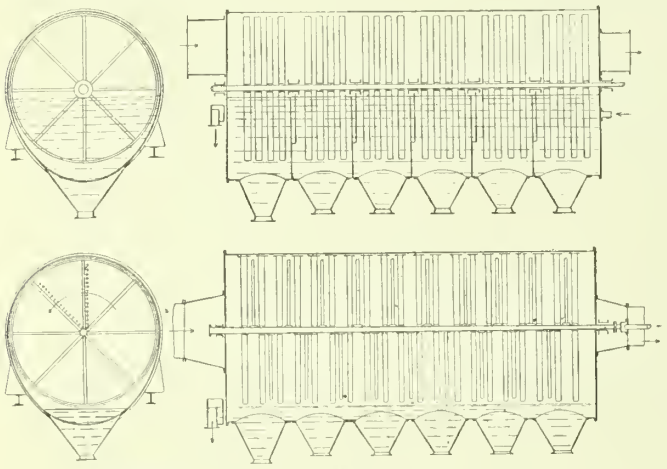
REGISTER OF PATENTS.

Cooling and Purifying Gases.

MEYER, A., and HASTERT, E., of Dudelange, Grand Duchy of Luxembourg.

No. 17,999; Aug. 10, 1906.

Hitherto, in order to cool blast-furnace gases for the purpose of using them as gases for heating or motive power, the patentees remark that two types of cooling apparatus have generally been employed. Those most generally used are cooling and washing towers with hurdles or gratings in which the gas to be cooled passes upwards through a vertical cylindrical vessel, while a finely-divided current of water circulates in the apparatus in the opposite direction, and absorbs a large part of the heat of the gas. A second type of cooling apparatus [that shown in the engraving] consists broadly of a cylindrical vessel in which there rotates a shaft carrying a certain number of circular sieves. The vessel is filled with water in such a manner that the rotary sieves are immersed in the water approximately to the axis of rotation, and therefore become re-charged with water at each revolution. The gas traverses the vessel in the longitudinal direction above the level of the water, and is obliged to pass through the close meshes of the sieves charged with water in such a manner that intimate contact is produced, and consequently an active exchange of heat between the gas and the drops of water upon the surface of the sieves. The water traverses the apparatus in the opposite direction to the stream of gas—this being obtained by suitable partitions. Simultaneously, some of the impurities contained in the gas are separated, and deposited upon the meshes of the sieves; and it is intended that this should be removed when the sieves enter the water.



Meyer and Hastert's Gas Cooler and Purifier.

Nevertheless, experience demonstrates that this takes place only if the water is pure. After a certain time, the water becomes charged with impurities to such an extent that it is no longer suited for washing the sieves.

In the improved apparatus, the sieves are assembled with the casing, and the partitions are entirely dispensed with, in such a manner that the impurities which float upon the surface of the water are able to escape freely through the discharge opening; and the level of the water is lowered in such a manner that the sieves no longer enter the water, and the whole of their surface may be utilized as a cooling surface. The sieves are sprayed by pairs of pipes, which proceed from a hollow rotary shaft and extend radially as far as the outer casing. These pipes are provided with spraying holes arranged in such a manner that, owing to the reaction of the water which escapes, the desired rotation of the shaft and of the entire system of spraying pipes is obtained. The total surface of the sieves is completely sprayed twice during each rotation, with fresh water under pressure. By this means, on the one hand, the entire surface of each sieve is uniformly covered with water; and, on the other, the particles of dust deposited by the gas in the meshes are constantly carried off by the washing.

The upper illustration shows in longitudinal and cross vertical section apparatus as hitherto generally used, with rotary sieves dipping almost up to their axes in water; the partitions forcing the water to pass through the apparatus in a zig-zag way. The lower illustration shows apparatus constructed according to the present invention. It consists of a cylindrical casing or vessel placed horizontally and provided at the bottom with funnels for emptying it by means of slides when required. A hollow shaft is connected by a stuffing-box or other suitable joint to a supply pipe which leads water under suitable pressure into the apparatus. From the shaft perforated branch pipes extend radially almost to the inner surface of the casing, perforated discs or sieves are arranged, firmly secured to the casing and surrounding the hollow shaft which loosely passes through it. One disc or sieve is placed at both sides of each branch-pipe. The spent water escapes by an outlet or overflow, the level of which is kept as shown, so as to prevent the discs or sieves from dipping therein. The gases to be cooled and purified are introduced at the left side of the apparatus, and escape at the opposite end.

Treatment of Gases for the Extraction of Ammonia.

FELD, W., of Hönningen-on-the-Rhine, Germany.

No. 18,505; Aug. 17, 1906.

This invention relates to the extraction of ammonia from gases containing ammonia—such, for instance, as coal gas and the like.

Hitherto such gases, the patentee remarks, have been washed with water in order to obtain ammoniacal liquors; but, in consequence of the volatile nature of ammonia, the resulting ammoniacal liquor has been very weak and a considerable amount of ammonia has been left in the gases—to an extent at least corresponding to the tension of the ammonia in solution at the temperature of the gases—and the ammoniacal liquor has been contaminated by sulphur and other impurities from the gases. In distilling this weak and impure ammoniacal liquor, not only does a considerable loss of ammonia occur, but part of the impurities (such as sulphuretted hydrogen) is distilled off with the ammonia, and the ammonia compounds produced are impure and of low concentration.

In order to obtain pure and concentrated ammoniacal liquors from which the ammonia can be produced by distillation in a concentrated and pure condition, the patentee proposes to wash the gases with a solution of a salt of magnesia, such as a chloride, a sulphide, a nitrate, or the like. In washing the gases with a solution of (say) sulphate of magnesia, under the simultaneous reaction of ammonia and carbonic acid, carbonate of magnesia and sulphate of ammonia are formed and sulphuretted hydrogen is absorbed. The ammonia is completely extracted from the gases; the strength of the ammonia sulphate solution employed depending on the strength of the magnesia salt solution used. On boiling this mixture of magnesia carbonate and ammonia sulphate, magnesia sulphate is regenerated, while carbonic acid and ammonia are distilled off—the ammonia being pure and concentrated. It is not necessary to boil till all the ammonia salt is decomposed, because the regenerated magnesia solution can be used over and over again for the gas washing process; and therefore the ammonia left in the solution after distillation is not lost, because it will be recovered at the next (or a succeeding) distilling operation.

The nature of the carbonate of magnesia formed by the action of the gases upon the magnesia salt solution depends on the molecular proportion in which carbonic acid and ammonia are in the gases. If the proportion be less than one to two, basic magnesia carbonate is formed; while if it be more than one to two, a mixture of basic carbonate with neutral carbonate (or even with bicarbonate of magnesia) is formed. The nature of this carbonate, or these carbonates, does not interfere with the completeness of the extraction of ammonia.

The washing process may be carried out in any suitable washer; the resulting mixture of magnesium carbonate and ammonia salt being muddy. The "most suitable washer" is said to be that described in patent No. 11,206 of 1905.

The following is an example of how the invention may be performed—magnesium chloride being taken as the salt of magnesia employed for the absorption of ammonia, and ammonium chloride being taken as the salt used to prevent the precipitate of carbonate of magnesia from becoming too thick or stiff. From 150 to 250 grammes of magnesium chloride and from 50 to 150 grammes of ammonium chloride are dissolved in 1 litre of water; but other proportions and consequent concentration may be used—the quantity of salts employed depending on the amount of ammonia to be absorbed. The gases may, for instance, contain 1 molecular proportion of carbonic acid to 2½ molecular proportions of ammonia. On the gas being passed through the solution, ammonia and carbonic acid will be absorbed and magnesium carbonate will be precipitated. After nearly all the magnesium salt is decomposed, the mixture is run into the distilling apparatus and heated. First carbonic acid will distil off—this containing the more ammonia the higher the temperature rises. With the distillation of the ammonia the precipitate of magnesium carbonate diminishes; chloride of magnesium being regenerated at the same time. It is not necessary to boil so long that all the ammonia salt is decomposed, as the liquor can be re-used for absorption, even if there be left in the solution as much as 20 per cent. or more of the ammonia. After being cooled to such a temperature that no further ammonia distils off, the liquor can be re-used for absorption. The presence of the excess of ammonia salt added to the magnesium salt in the solution prevents the liquor from getting too thick or stiff, either in the absorption apparatus or in the distilling apparatus.

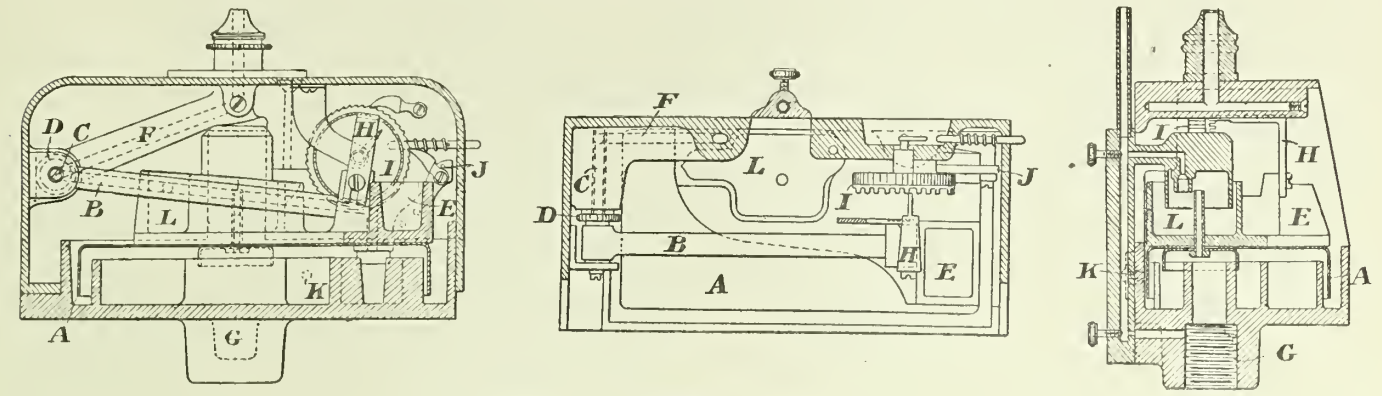
Gas Lighting and Extinguishing Apparatus.

JACOBSEN, J., of Elsinore, Denmark.

No. 21,247; Sept. 25, 1906.

This invention has reference to apparatus for lighting and extinguishing gas-flames of the type comprising a reservoir or diaphragm which floats in quicksilver, and is provided with means for rotating a cog-wheel, which latter influences the movements of the reservoir to cut off the supply of gas to the main burner; this being effected through the agency of either the first or the second lowering of the pressure in the main, after the ignition of the burner is caused by an increase of pressure. The pressure of gas in the mains may be repeatedly increased and diminished without the apparatus opening for the inlet of gas, whereas this takes place when the predetermined number of changes of pressure prescribed for the respective apparatus have been made. It is also possible to let the supply of gas continue until a certain number of diminutions of pressure have taken place. It is thus possible from the gas-works to fully control all the lamps—*i.e.*, to light all of them or one or several groups of them, and also to extinguish certain groups of lamps, while other groups remain lighted, and finally to extinguish these.

To the casing of the apparatus is screwed a bottom with channels containing quicksilver, in which floats a bell A in connection with a pipe B opening therein at one end, and having its other end connected to a pipe C, turnable in a bearing in which is a stuffing-box D. Upon the top of the reservoir is a chamber E, in which small shot and the like can be placed to regulate the load of the reservoir. The pipe C discharges by a hole into a canal F, to which is screwed a pipe on which the gas-burner is placed. In the bottom of the apparatus is also provided an inlet-opening G for the gas. On the pipe B is arranged an angle-arm H, turning upwards and bearing a tooth. Within the casing of the apparatus is a wheel I, which has ratchet-teeth on its periphery, and at the side bears a flange cut away to form a second set of teeth, and against which the tooth on H either strikes or with which it gears, according to the movement of the reservoir A. Arranged on the reservoir is a fitting J with a pawl which points upwards, and is revolvable on a screw-pin, and which, when the reservoir A is lifted, will rotate the wheel I, whereas this will remain



Jacobsen's Lamp Lighter and Extinguisher.

stationary while the reservoir is lowered. In order to prevent the wheel I from turning back, there is arranged on a peg a pawl which is movable around a screw.

To operate the apparatus, the quicksilver is filled in until it is discharged through the opening K and the bye-pass flame is lighted. If the pressure is increased, the reservoir A and the pipe B will be lifted, whereby the wheel I is revolved. If it is not intended thereby to light the lantern, the cog-wheel must beforehand be constructed in such way that the tooth on H pushes against one of the teeth of the cog-wheel; and the lamp will then only be lighted after the pressure has been diminished and is then again increased, as the tooth will go between two teeth on the cog-wheel. If it is intended to light the lamp by the first increase of the pressure, the ratchet-wheel must be constructed in such way that the tooth can at once pass through. For lamps which are to be extinguished by the first diminution of the pressure, the interval between the corresponding teeth on the cog-wheel must be so large that the tooth on H on the way back again can pass between the teeth. If, however, the lantern is to remain lighted in spite of the diminution of the pressure, the ratchet-wheel must, by its continued rotation during the lifting of the reservoir, at last show a flange tooth below the tooth, so that this, when the reservoir is lowered, will strike against the cog-wheel, and stop the lowering of the reservoir, whereby the introduction of gas is continued without any hindrance. When the necessary higher pressure is again produced, the wheel will rotate, and by ensuring diminution of the pressure the reservoir can get quite down, the pipe B immerses in the quicksilver, and the inlet of gas is interrupted.

When the reservoir A is lowered, the gas will pass to the bye-pass or lighting-flame; and if the main flame is to be lighted, the reservoir A is lifted, and thereby the reservoir L. The quicksilver in the reservoir L will thus be immersed, and thereby the inlet of gas in this way to the lighting-flame is interrupted.

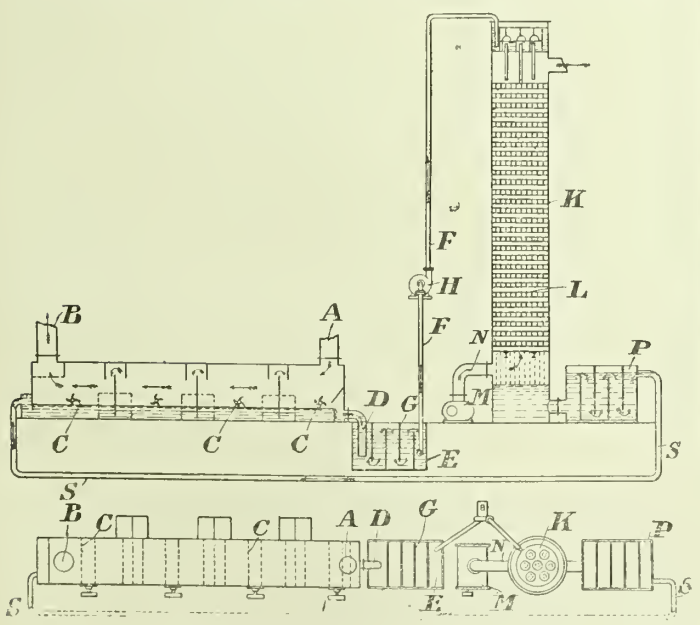
Ammonia-Recovery Gas Plants.

Crossley, W. J., and Rigby, T., of Manchester.

No. 24,144; Oct. 30, 1906.

This invention, relating more particularly to producer gas plants, is designed with a view to recovering ammonia.

In such a process, in order to obtain a large yield of ammonia, it is desirable to work the producers at a low temperature; and this is usually done by arranging for a large quantity of steam to be mixed with the air passing through the producer. A portion of the excess steam passes through the producer undecomposed; and "to make the process an economic success, it is not only necessary to recover the ammonia, but it is essential that the great quantity of latent heat present in the water vapour should be recovered from the gas." In most of the processes employed the ammonia is recovered at a temperature above that at which the water vapour is condensed, and before it is condensed. But in patent No. 20,716 of 1901, a process was described which "was calculated to simplify methods hitherto in use by condensing the water vapour and tars in the gas before the ammonia was absorbed." This was done in a special way, and the plant was considerably simplified and the process made easier to work.



Crossley and Rigby's Ammonia-Recovery Plant.

The object of the present invention is to still further simplify the process; and, instead of recovering the latent heat of the water vapour separately and the ammonia separately, the operations are combined.

In the earlier process, the washer employed was split up into compartments, with the object of making zones of temperature; the water contained in the washer travelling constantly in the direction of the hottest end. This hot water was then pumped through an air-saturating tower, with the object of saturating the air supply to the producers with water vapour and cooling the water—the cool water flowing back to the coolest end of the washer and then re-circulated. The apparatus was also arranged in such a manner that the ammonia was not lost—being passed onwards with the gases to an ammonia-absorbing tower. In the present invention, sulphuric acid is added to the water circulating in the washer in such quantities that there is always present in the liquor a small amount of free acid; and thus a fairly concentrated solution of sulphate of ammonia is obtained and circulated instead of water. The actual sulphate liquor thus becomes the medium for interchanging the heat of the gas and the water vapour condensed, and also washes the gas; the small percentage of free acid present in the liquor absorbing the ammonia in the gas. The water vapour from the gas condensed by the liquor in the washer is added to this liquor, and is more or less afterwards recovered in the air-saturating tower; portions of the liquor being taken off as required for further concentration by evaporation and crystalization in the usual manner.

In operation, the gas, after leaving the gas-producers and air superheating apparatus, enters the washer at A, and, passing into the first compartment, meets the spray raised by the paddle in this compartment. As it passes on (as shown by the arrows) into each successive compartment, it meets the spray raised by the paddles in each compartment—finally leaving the washer at B. The temperature in each compartment varies; the liquor flowing along the bottom of the washer in the opposite direction to the gas. The heated liquor leaves the washer by means of the sealed pipe D and enters the hot well E suitably arranged with baffles G.

The pump H is arranged to raise the liquor in the pipe F from the hot well to the top of an air-saturating tower K, whence it is distributed uniformly down the checkerwork L with which the tower is packed. Air from the blower M enters the air-tower at N, and is blown through the checkerwork in the opposite direction to the down-coming circulating liquor, and leaves the top of the air-saturating tower K saturated with water vapour. The circulating sulphate liquor leaves the foot of the air-saturating tower considerably lower in temperature, and passes into the baffle-box P, whence it flows by gravity, along the pipe S, back to the cool end of the washer to be again circulated, and so on continuously.

The patentees say they find in practice that any ammonia contained in the tar or other impurities brought down in the washer is absorbed by the sulphate liquor, so that practically all the ammonia contained in the gas is recovered and converted into sulphate of ammonia. A greater yield of ammonia per ton of fuel can thus be obtained.

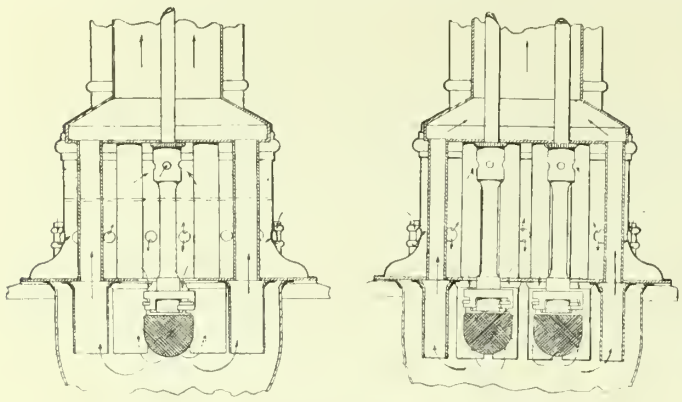
Inverted Incandescent Gas-Lamps.

Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft), of Berlin.

No. 26,767; Nov. 24, 1906. Date claimed under International Convention, Nov. 28, 1905.

This invention relates to regenerative incandescent gas-lamps having one or more inverted burners, and in which the external air to support combustion is supplied directly to the incandescent bodies from a preheating chamber arranged in the lamp-casing; the supply being in the direction of the current of gas supply to the burner through openings in the base of the chamber, and the drawing away of the gases of combustion taking place through separate passages grouped round the burner tubes, and carried into the uptake chimney through the preheating chamber for the air.

The passages through which the gases of combustion are drawn away are carried downwardly into the globe space surrounding the incandescent bodies to about the level of their lower edge when suspended in the globe which surrounds them. This arrangement is said to present in many respects important advantages. The incandescent bodies can be so arranged as to be easily accessible, and there is therefore no danger of their being injured by the replacing and removal of the cylinders over them. The illuminating effect is, it is claimed, increased to the extent that the rays of light do not have to pass through a cylinder surrounding the incandescent bodies, but for the greater part emerge directly through the outer globe of the lamp.



German Forms of Inverted Incandescent Lamps.

In the engraving, two forms of this improved inverted burner lamp are shown in central vertical section.

In the first one, there is arranged a burner comprising a mixing-device, mixing-tube, and burner-head, with incandescent suspended body. The mixing-device is in a chamber into which the air enters from outside through openings. In this construction, the passages for the combustion gases extend through the air chamber, and communicate at their upper ends with the chimney which surrounds the gas-supply pipes, and at their lower ends are prolonged downwards into the space of the globe by means of tubular sockets. These sockets may preferably be removably attached to the base of the air chamber; they may also in some cases be formed in one piece with the passages. The lower mouth or edge of the tubular extensions extend to approximately the same level as the lower end of the incandescent body.

In operation, the air flows through the openings, as shown by the arrows, into the air-chamber, whence it is conveyed, on the one hand, to the mixing-devices and, on the other, passes through openings into the interior of the globe. The air receives a preheating in the air-chamber through the heating action of the passages, and a further preheating through its flowing past the mantle-suspending devices—the latter being simultaneously cooled. The air preheated in this manner flows downwardly into the globe space surrounding the incandescent body, and afterwards escapes upwardly into the chimney through uptake passages. This arrangement, "owing to the axial carrying-off of the hot gases, in addition to the advantages already set forth, presents the further advantage that heating of the globe is substantially lessened."

In the construction shown, the burner is arranged in the middle of the lamp, and is surrounded by a series of uptake passages, all of which are prolonged over the suspension means by tubular continuation pieces; the arrangement being such that the preheating of the air in the air-chamber is favoured. In the second form, however, a plurality of burners are arranged in the middle of the lamp, and surrounded by a ring of uptake tubes with the corresponding prolongations. This arrangement enables the incandescent bodies to be brought into as close as possible proximity to each other, and a concentration of the source of light to be thereby attained.

APPLICATIONS FOR LETTERS PATENT.

18,159.—Mouneyrat, A., "Burners for lighting and heating." Aug. 10.
18,170.—Claussen, F. G., and Romolo de Fazi, "Manufacture of a combustible gas." Aug. 10.
18,196.—Armstrong, J., "Manufacture of coke and gas." Aug. 12.
18,254.—Wolf, L., "Gas cooling apparatus for gas producing plants." Aug. 12.
18,292.—Barnes, F. G., "Tar spraying and road brushing machine." Aug. 13.
18,298.—Carter, A. E., "Street lamp." Aug. 13.
18,324.—Bayes, R. J. H., and Hill, A. B. L., "Generating acetylene gas." Aug. 13.
18,356.—Evered and Co., Ltd., and Read, E. T., "Gas-valves," Aug. 14.
18,376.—Bristowe, F., and Stapley, A., "Heating tar and spreading same on roadways." Aug. 14.
18,415.—Humphrey, A. H., "Gas-lamps." Aug. 14.
18,424.—Lewis, J., "Lighting incandescent gas burners or lamps." Aug. 15.
18,433.—Mitchell, T. H., "Gas-engine." Aug. 15.
18,446.—Yarrow and Co. (Bolton), Ltd., and Yarrow, M., "Joints of pipes or mains." Aug. 15.
18,469.—Zimmer, G. F., "Conveyors." Aug. 15.
18,476.—Friend, J. E., "Gas-engine." Aug. 15.
18,506.—Willocq-Bottin, E., "Acetylene generators and the like." Aug. 15.
18,524.—Chandler, S. & J., "Grids or hurdles for purifiers." Aug. 16.
18,553.—Stevens, C. R., "Gas or liquid fuel boiler." Aug. 16.
18,555.—Dix, C., "Opening and closing gas or other valves." Aug. 16.
18,561.—Mount, L. de B., "Gas-producers." Aug. 16.
18,567.—Buck, J., and Them, H., "Acetylene-generators." Aug. 16.
18,590.—Kautz, M., "Gas blow pipes." Aug. 16.
18,649.—Koffler, H., "Generating acetylene gas." Aug. 17.

At the monthly meeting of the Heywood and Middleton Water Board last Thursday, it was reported that the total expenditure on the Ashworth Moor new reservoir, &c., up to July 31, including £32,078 for lands purchased and interest during construction, amounted to £204,983, exclusive of £6580 for plant.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Gas Centenary: Sliding-Scale and Auction Clauses.

Sir,—I note the letter in your last issue from Sir George Livesey on the above; and, in view of the publication of the "history" in book form, I welcome his criticism and correction, "so that the proposed re-publication may be as accurate as possible."

Taking the Sheffield and West Ham Companies sliding-scales and putting them on one side on account of their incompleteness and imperfect character, London can claim to be the originator of a true both-way sliding-scale as applied to gas companies. That being so, the father of the sliding-scale is Sir George Livesey, who, as I stated, "at a meeting of the British Association of Gas Managers in 1874 dealt warmly with the question, and strongly advocated an up-and-down unlimited scale, giving an increase of dividend for every reduction of price below, and making an increase for every rise in price above, a fixed limit." It is true that, owing to the defective nature of the 1869 and 1874 one-sided sliding-scales of the before-mentioned Companies, they are no longer operative.

With regard to the auction clauses, I have always understood that the Commercial Company took the sliding-scale in 1875, when the other Companies refused it; and the words in my "history" are from the parliamentary proceedings on the Metropolitan Gas Companies, 1889—viz., "Treated with some favour by Mr. Foster's Committee in 1875, because they took the sliding-scale when the other Companies refused it in that year. Mr. Foster in consideration did not impose the auction clauses upon them."

Sir George, speaking at this date of his introduction of the sliding-scale, said: "Strange to say all the Companies (mine included) refused the sliding-scale in 1875. Except the Commercial, the whole of the Companies were against me." I am glad of the correction and additional information.

In compiling this history, I have in no wise gone out of my way to introduce the name of Sir George Livesey; but in my research the name so continually cropped up during the last forty or fifty years of the gas industry, that I was compelled to insert it as frequently as I did. The only compunction I have is in having done so little justice to one who by his intelligence, foresight, tact, and determination, has done so much to raise the industry to its present proud position, and whose name will rank with that of Clegg the great gas engineer of the first forty or fifty years of gas manufacture, who by his inventive faculty and indomitable courage lifted the industry from the rut in which it found itself in those early days.

Aug. 22, 1907. The Writer of the "History."

PARLIAMENTARY INTELLIGENCE.

Water-Works in Rural Districts in Ireland.

The expenses attending the construction of water-works in rural districts in Ireland were the subject of a question put to the Chief Secretary for Ireland last Friday by Mr. Boland, the Member for South Kerry. He asked the right honourable gentleman whether he was aware that the Local Government Board had charged the electoral division with the expense of the Portmagee Water-Works, while in the case of the Cahirciveen works, in the same District Council area, the charge had been made a Union charge; whether he could explain why, in the case of Portmagee, the money was payable in 20 years at 7 per cent., whereas in the case of Cahirciveen it was payable in 50 years at 3¾ per cent.; and whether, seeing that the Rural District Council had applied for an extension of time, from 20 to 50 years, for repayment as regards the Portmagee scheme, he would see that equal treatment was given to the two schemes. In reply, Mr. Birrell said the Local Government Board had made orders fixing the district electoral division as the area of charge for the Portmagee works, and the rural district as the area of charge for the Cahirciveen works. In the former case, the Rural Council would only agree to the district electoral division as the area of charge; and the resolution of the Council requesting the Board to fix this area was proposed by the councillor representing the electoral division. A large proportion of the expenditure had been guaranteed from outside sources, and, as the amount falling on the rates would not in consequence press unduly on the ratepayers in the electoral division, the Board did not feel warranted in withholding their approval of the area desired by the Local Authority. In the Cahirciveen case, the area was fixed as the rural district, with the consent of the Rural District Council. The loan for the Portmagee Water-Works was repayable in 20 years, with interest at 3½ per cent. per annum; and the period for repayment for the Cahirciveen scheme was 30 years, and the interest 3¾ per cent. The periods in both cases were fixed by the Board after due consideration of the character and durability of the works. No application had been made to the Board for an extension of the period in the Portmagee case.

Prosecutions for the Prevention of Corruption.—In the House of Commons last Thursday, Mr. Lupton asked the Attorney-General in how many cases his consent had been sought for a prosecution under the Prevention of Corruption Act, 1906, and in how many he had given it. Sir John Lawson Walton, in a written reply, said there had been four applications, and fiats had been granted in three cases; the other being at present under consideration. Convictions had been obtained in all cases.

LOCAL AUTHORITIES AND WATER RIGHTS.

A Bill has been introduced by Mr. Leif Jones, the Member for Appleby, to empower local authorities to acquire water rights otherwise than by agreement. A memorandum prefacing the Bill sets forth that its object is to amend a defect which has been found to exist with regard to the taking of water. The Select Committee of the House of Commons on the Public Health Act (1875) Amendment Bill (1878) reported as follows:—

From the date of the passing of the Public Health Act up to last session of Parliament, it was believed that Provisional Orders could be obtained under the Act by which water rights could be compulsorily taken. Several Provisional Orders have been obtained under the belief that the compulsory taking of water rights by Provisional Order was legal under the meaning assigned to the word "lands"—this word being defined to include "messuages, buildings, lands, easements, and hereditaments of any tenure;" and it was thought that under the definition a local authority could purchase water rights compulsorily under the 176th section of the Act of 1875. During the last session of Parliament, a Committee of the House of Lords, when considering a Provisional Order for the compulsory purchase of water rights under that section by the Local Board of the West Houghton district, decided that the Order was *ultra vires*, and consequently it was not confirmed.

The Law Officers of the Crown were then consulted, and they advised: "We are of opinion that, in issuing a Provisional Order under the 176th section of the Public Health Act, 1875, the Local Government Board cannot confer upon a local authority power to purchase for the purposes of the Act and otherwise than by agreement any right to abstract water from any stream."

It follows from this that a Provisional Order which proposes to take water rights otherwise than by agreement cannot be made under the Public Health Act.

The Committee are of opinion that this decision will produce serious inconvenience to sanitary authorities; for it is apparent that, before water from a stream can be taken by a sanitary authority for the water supply of its district, an agreement would have to be made with every owner, lessee, and occupier below the proposed intake who may be affected by the abstraction of the water. The statement of the case is sufficient to show how difficult it would be to obtain the consent of those having these water rights. A sanitary authority could still obtain compulsory powers by a Private Bill; but it has been pointed out that the cost of obtaining a Private Bill is much higher than that of obtaining a Provisional Order.

The Committee therefore recommend that, with the view of affording to local authorities facilities for acquiring the right to take water from any stream, the Local Government Board should be empowered to issue Provisional Orders which, on confirmation by Parliament, would confer powers on the local authority for the purpose. The Committee are of opinion that the Provisional Order should incorporate the Water-Works Clauses Act, 1847, in the same manner as is usual in a Private Bill; but prior to the issue of the Provisional Order, the notices which in the case of a Private Bill would be necessary, under the Standing Orders of Parliament, should in all cases be published and served by the local authority.

This Bill carries out the above recommendations.

Clause 1 sets forth that for the purpose of enabling any local authority to supply water, there shall be incorporated with the Public Health Act, 1875, as amended by the proposed Act, the provisions of the Water-Works Clauses Act, 1847, with respect to the making of waterworks; and in the construction of such provisions the term "the Special Act" is to include the Public Health Act, 1875, as amended by the proposed Act, and any Order confirmed by Parliament authorizing a local authority to take, divert, collect, impound, or appropriate the waters of any stream otherwise than with the consent of the owners or occupiers of such stream, or the other parties, if any, interested in the same.

The second clause provides that, notwithstanding anything in the Public Health Act, 1875, to the contrary, any local authority, subject as subsequently provided, may, for the purpose of supplying any water-works which may have been constructed, or which may be proposed to be constructed, by them, take, divert, collect, impound, and appropriate such of the waters of any stream, whether within or beyond their district, as they may require for the purposes of water supply.

It is specified by clause 3 that the local authority, before interfering with the waters of any stream under the foregoing powers, otherwise than with the consent of the owners and occupiers, and of the persons, if any, whose consent under the Public Health Act, 1875, would be required, are to (1) publish once at least in each of three consecutive weeks in the month of November in some newspaper circulated in their district, an advertisement describing shortly the nature of the works which have been constructed, or which it is proposed to construct, naming a place where a plan of such works may be seen at all reasonable hours, and stating the name by which the stream is known at the point at which the water will be taken, the name of the parish in which such point is situate, and the quantity of the water which it is proposed to take; and (2) also to serve a notice containing the like particulars, in the month of December, on every owner or reputed owner, lessee or reputed lessee, and occupier of the mills, manufactories, and other works using the waters of the stream for a distance of 20 miles below the point at which the waters are intended to be taken.

On compliance with the foregoing provisions, the local authority, under clause 4, may present to the Local Government Board a petition under their seal, describing the nature of the works which have been constructed, or which it is proposed to construct, and shall state the name by which the stream is known at the point at which it is intended to take the waters, the parish in which such point is situate, the quantity of the waters which it is proposed to take, and the names of such owners, lessees, and occupiers who have assented, dissented, or are neutral in respect of the taking of such waters, and who have returned no answer to the notice. The petition shall pray that the local authority may be authorized to take, divert, collect, impound, or appropriate such waters otherwise than with the consent of the owners, lessees, and occupiers of the stream and other persons (if any) interested in the same; and the prayer is to be supported by such evidence as the Board may require.

On the receipt of the petition, and on due proof of the proper advertisements and notices having been published and served, the Local Government Board are to take the petition into consideration, and may either dismiss it or direct a local inquiry to be held. After the completion of the inquiry, the Board may, by Provisional Order, empower the local authority to take, divert, collect, impound, and appropriate the waters referred to in the petition, or any of them, otherwise than with the consent of the owners, lessees, and occupiers of the stream, and of the other persons (if any) interested in the same, and either absolutely or with such conditions and modifications as the Board may think fit; and the local authority are to serve a copy of any Order so made in the manner in which, and on the persons and on whom, the notices already referred to are required to be served.

The proposed Act may be cited as the Public Health Act (1875) Amendment (Water Rights) Act, 1907; and it is to be read as one with the first-named Act.

A New Standing Order.

The Standing Orders of the House of Commons have just been amended by the addition of the following Order (No. 36A) relating to the estimate of expenditure in case of works to be executed by a local authority: "On or before the 31st day of December, copies of the estimates of expenditure for any permanent works proposed to be executed by any municipal corporation, district council, joint board, or joint committee, or other local authority in England or Wales, shall be deposited at the Office of the Clerk of the Parliaments, and at the Office of the Board of Trade, or of the Local Government Board, as the case may require. The estimates shall be in the following form, or as near thereto as circumstances may permit:—

Estimate for Permanent Works.

	£ s. d.
Purchase of land and easements	
Buildings (specifying generally their nature)	
Reservoirs, filter-beds, &c..	
Tunnels, embankments, dams, &c.	
Trunk mains and main sewers	
Other mains, pipes, sewers, and sewage disposal works	
Other works grouped with regard to the probable life of the works	

If any moneys are required to be borrowed in excess of expenditure previously authorized by Parliament, the Board of Trade, or the Local Government Board, there shall be deposited with the estimates a statement of the purposes and reasons for the borrowing. Together with the estimates, there shall be deposited a statement showing the following particulars with respect to the district of the local authority, that is to say: (*a*) Area of district; (*b*) population according to the last census; (*c*) rateable and assessable value according to the last valuation list; (*d*) rates made in district during the last preceding financial year; (*e*) sum of balances of outstanding loans contracted by local authority; and (*f*) amount of outstanding loans to which the limitation of section 234 of the Public Health Act, 1875, applies."

LEGAL INTELLIGENCE.

A NEW GASHOLDER FOR ELGIN.

The Question of Dispensing with Consents.

On Tuesday last, Sheriff Wilson, K.C., held an inquiry in Elgin into an application by the Town Council of Elgin for an order dispensing with the consents of inhabitants within 300 yards of a site upon which the Council propose to erect a gasholder. The maximum daily consumption of gas during the past winter was 200,000 cubic feet; while the gasholder capacity is only 80,000 cubic feet. The Council, upon a report by Mr. J. Kay, the Gas Manager, resolved upon the erection of a new holder to give capacity equal to the maximum daily output. Three sites were considered—one upon Lossie Green, contiguous to the gas-works; another at the Pans, where the sewage-works are situated; and the third at the North Lane, in the centre of the town, where the Council own land sufficient for the purpose. The Council decided upon the North Lane site; but objections to it were lodged by owners and occupiers of properties adjoining.

Mr. Hugh Stewart, the Town Clerk, represented the Council; and Mr. D. Jameson appeared for the objectors.

Mr. *A. A. Turriff*, the Burgh Surveyor, said that the proposed gasholder would only be seen from the upper back windows of the houses of the objectors. The site was 115 yards from the gas-works; and the houses of the objectors were from 80 to 120 yards distant. He considered that the holder would not be the cause of depreciation of properties.

The Town Clerk said it was found that the gasholder could not be built in the Public Park or the Cooper Park, because they were given for public amusement. Lady Seafield refused to give them Lossie Green, because several of her feuars objected to its being put there. With regard to the field at the Pans, all the ground there was required for the sewage-works. The Town Council agreed, by 11 votes to 5, to erect the gas holder on the site proposed.

Mr. *J. Kay*, the Gas Manager, said he reported as far back as 1905 that a new holder was necessary; and he afterwards reported, in January, 1907, that such a thing was an absolute necessity. He would have preferred the site on Lossie Green, as it was close to the works and more convenient. The next best site was on the ground at Pans. There was sufficient ground for a holder there, but not for gas-works. There would be certain loss there by condensation; and his estimate of the extra expense was £1500, and the additional annual expense of carrying on the work at Pans would be about £80. There ought to be no smell about a gasholder; and if there were leakage, they would easily detect it. The proposed gasholder, when full, would rise 60 feet

above the ground. This was greater than the present holders, which were 34 feet high. The proposed holder would be kept filled in the winter afternoons for several hours, but not during the summer. It was not possible to erect the structure inside the present ground at the gas-works, even supposing his dwelling-house were knocked down. The consumption of gas was increasing yearly ; and this ground might yet be required for extending the works.

In cross-examination, the witness said the pipe to the proposed site would not cost much over £100. He always rectified a leakage when it took place. There was a loss by leakage last year of over 6 million cubic feet. This did not take place at the gasholder, but in the main pipes. At the present time the leakage amounted to 17,000 cubic feet, on an average, per day.

Mr. *A. Yuill*, of Dundee, said there was no room at the present gas-works for a gasholder ; all the spare room would be required for future extension of the works. He would prefer to erect the holder on Lossie Green for the simple reason of having it near the works. The difference in the expense at Lossie Green or at the proposed site would be immaterial. If the holder were erected at the Pans, which was about a mile distant, a much larger pipe would be required than if it were put at the back of the model lodging-house. The extra cost would amount to from 1½d. to 1¾d. per 1000 cubic feet. He could see no serious objection to the holder being erected on the site proposed. If the water-seal were properly attended to there ought to be no smell. He did not consider there was any danger of explosion—the gas-works were situated about 120 yards from the proposed holder. All the complainers' houses were within 300 yards of the present gas-works.

Mr. *S. Milne*, of Aberdeen, considered the site proposed was suitable ; but he would have preferred it on Lossie Green, as it would have been closer to the works. He did not consider the site at the Pans such a good one as that proposed, as it was farther from the works. He considered the capital expenditure would be about £2250 extra. This would add from 1½d. to 1¾d. per 1000 cubic feet, which at present cost 3s. 9d. He would not consider a gasholder objectionable on the site proposed. Gasholders in towns did not appear in any way to affect the feuing ; and he knew of some valuable houses being erected in their vicinity. He would have no hesitation in introducing a gasholder in the centre of a town if the gas-works were already there.

The Sheriff : What would you think was the object of the Legislature in enacting that gasholders were not to be erected within 300 yards of dwelling-houses ?

Witness : I do not know what could have been in their minds at the time.

Mr. *J. Wittel*, an architect, of Elgin, did not think that the erection of the holder would depreciate the value of property in the immediate neighbourhood.

Mr. *A. Ramsay*, of Longmorn, said he was one of the largest ratepayers in the town of Elgin. He considered that the erection of the proposed gasholder would depreciate the value of his property. On the lower part of his ground, he proposed building a good class of workmen's houses ; and he considered it would depreciate these, and also his his property in High Street. He had been 17 years in the Council, and was also a Magistrate for several years. When he built his property he did not anticipate that they would propose to put up this gasholder, and, as a ratepayer, he objected. From a public point of view, he did not think it was a proper course to distribute the gas-works over the town. He and others lodged a respectful petition to the Council. It was signed by leading men. They never were consulted. They were rather hurt at receiving no answer to their petition.

Cross-examined : If the gasholder were put up there, the chances were that the gas-works would always be kept in the centre of the town. It would appreciate the value and amenity of the locality if the gas-works were wholly removed.

Dr. *Alexander*, of North View, North Street, said he would see the proposed gasholder from several of his windows ; and he considered that it would very much depreciate the value of his property. He did not believe in gas-works being built in the centre of a town. There was considerable danger to health, he understood, from leakage. Gas-works were considered public nuisances.

Dr. *J. W. Norris Mackay* said his property would overlook the proposed gasholder. He most certainly regarded this step of the Council as a retrograde one. He scarcely saw the gas-works from his drawing-room ; but this holder would be in front, and would be an eyesore. He considered it would militate against all improvements in that vicinity, and would generally depreciate the value and the amenity of his property. It would also prevent him building houses.

Mr. *Charles C. Doig*, of Elgin, considered that the best site would be Lossie Green. He remembered that when the last gasholder was erected, about one-fifth of an acre was taken off Lossie Green. There was still ground there, if it could be obtained. As an alternative, he would suggest that they take down the Gas Manager's house and erect a holder of 160,000 feet capacity. There would still be room for an extension of the works. He considered the erection of the gasholder would depreciate the value of the property in the vicinity. At a distance of 110 yards, 43 feet of the gasholder would be visible from the bay window of Dr. Alexander's house ; and from Dr. Mackay's drawing-room window, 43 feet. From the upper storey windows almost the whole of the gasholder would be visible. In the vicinity there were workmen's dwellings, and it would depreciate their value.

Sheriff Wilson said he would delay giving his decision for a fortnight, with a view to allowing the parties an opportunity of coming to an amicable arrangement, the possibilty of which had been mentioned in the course of the evidence.

Richmond (Surrey) Water Supply.—Under the Metropolis Water Act, 1902, the Richmond Corporation acquired the plant of the Southwark and Vauxhall Water Company employed to supply the district, and became the sole water authority. The total outlay on this plant and the works previously carried out by the Corporation has been £146,567 ; but the net outstanding indebtedness is only £63,000. The trading profit, over a period of fifteen years, has averaged £5544 per annum ; and the aggregate net result of the Corporation's work as suppliers of water is a surplus of £3650.

MISCELLANEOUS NEWS.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday—Mr. H. Wade Deacon in the chair.

The Directors presented a statement of accounts covering the twelve months ending the 30th of June, and pointed out in their report that the total revenue was £619,020, and the expenditure £506,951 ; leaving a surplus of £112,069, which had been transferred to the profit and loss account. After deducting the amount taken for payment of the dividend declared in February, and the interest on the debenture stock, there remained a balance of £59,269, out of which they recommended that a dividend be declared for the past half year of 5 per cent. on the ordinary consolidated "A" stock, and 3½ per cent. on the 7 per cent. "B" stock created and issued under the Company's Acts of 1865, 1882, and 1886.

The Chairman, in moving the adoption of the report and accounts, said he had the good fortune to again congratulate the shareholders on a very successful year ; the total consumption of gas having increased by 2¼ per cent. There was no change in the statement of stock and share capital or of loan capital ; but on the capital account the small amount of £155 had been written off, owing to the fact that a large number of meters had been condemned as unfit for further use and had been destroyed. Turning to the revenue account, the total cost under the heading of "Manufacture of gas" for the year was £389,780, against £373,756 for the year 1906—an increase of £16,024. This was due to two causes. In the first place, more gas had been made, and therefore more material had been consumed ; and, secondly, the price of coal was higher than the previous year. The wages at the works had decreased in consequence of the introduction of labour-saving machinery. There was also a reduction of £1000 in the repairs account. The repairs were, however, still very high, amounting to £70,000. But this figure included £15,000 for work in progress. Another reason why the repairs were high was, as he had explained at previous meetings, that the Directors had adopted a deliberate policy of spending a large amount for renewal purposes and for improving the works generally. This policy they proposed to continue ; and he had no doubt they would see greater benefits from it than they had already received. There were certain things that were beyond their control ; for instance, the price of coal. Still, they had bought as cheaply as possible ; and, so far as he was aware, they had bought as advantageously as the majority of their neighbours. Therefore he did not think they had anything to regret on this score. With regard to the distribution of gas, the cost was rather higher this year than last because of the large number of meters which had been destroyed. Rates and taxes were apparently lower ; but this was apparent rather than real, because some of the matters were still outstanding, and he was afraid it was too much to hope that they would get their rates and taxes permanently reduced. There was a new item in the accounts this year consequent on the Compensation Act. The Directors had considered the matter very carefully, and had decided that it would be a right and proper thing for the Company to take the risk themselves and prepare against it. They had accordingly put aside £1000 to form the nucleus of a compensation fund ; and they proposed to increase the fund from year to year. The total expenditure on revenue account was £506,951 ; but on the other side of the account there were satisfactory increases. The price of gas was the same as before—2s. 6d. per 1000 cubic feet, which was the cheapest price at which it had ever been sold in Liverpool ; but the receipts from the sale of gas had increased by £12,835, which was very satisfactory. He was glad to report that this increase had occurred among all classes of consumers. With residuals, they had done very much better ; coke having brought in £8000 more, and tar £4000 more than in the previous year. With ammoniacal liquor, however, they had not done quite so well, having received £670 less on this item. The total receipts were £619,020 ; and there was a balance of £112,068 to carry to profit and loss account. They had to put to this the balance of £65,975 brought forward, which made a total of £178,043. From this had to be deducted interest on debentures and other interests, and they had a balance of £59,269 to go to next year's account, subject to the half-year's dividends. After paying these, there would be £6000 to carry forward. With regard to the future, the Directors had given to it a great deal of consideration. They estimated that they would have to pay next year something like £30,000 more for coal ; and this, by itself, was equal to an increase of about 2d. per 1000 cubic feet of gas. The price had been 2s. 6d. for the last two years ; and the Directors, being extremely loth to increase it without being absolutely compelled, had, after careful consideration, decided to wait for a time, and see how things progressed.

Sir Edward Lawrence seconded the motion.

Alderman Stolterfoht inquired whether the Directors had taken any steps with regard to the production of "Coalite."

The Chairman said the matter had been considered by the Directors, and at present they did not think it at all likely that anything would result. They would, however, watch the matter.

The report and accounts were then adopted.

On the motion of the Chairman, seconded by Sir E. Lawrence, the dividends recommended by the Directors were declared.

The retiring Directors and Auditor were re-elected ; and the proceedings closed with a vote of thanks to the Chairman.

BOURNEMOUTH GAS AND WATER COMPANY, LIMITED.

Increased Gas Consumption—No Advance in Price—Assessment Dispute—Gas for Water Heating—Gas for Power on the Works.

The Ordinary General Meeting of this Company was held last Friday, at the London Offices, No. 90, Cannon Street, E.C.—Mr. G. Crispe Whiteley in the chair.

The Secretary (Mr. William Cash) read the notice calling the meeting ; and the Directors' report and the accounts were taken as read.

The CHAIRMAN, in moving their adoption, said that reading the accounts of the half-yearly meetings of other gas companies, and the somewhat lugubrious remarks of some of the Chairmen, and noting the cases in which the price of gas had had to be increased, he had been bracing himself up for a somewhat more serious effort than it was usually his pleasure to address to the proprietors at their half-yearly meetings. Having felt that possibly he might have a more serious tale to tell, the proprietors could imagine it was with peculiar pleasure that, in spite of surrounding circumstances, he was able to lay before them a statement of accounts and condition of affairs which was quite as satisfactory as, if not more so than, those of past half years. There were good increases under every head. They were proposing to pay what he was pleased to call their usual dividends; and the Directors were, in accordance with their policy, writing down at the rate of £6000 a year the amounts spent in replacing the old gas-works by the new ones at Poole. And yet they had an increased carry-over. So far so good. He was not sure, looking into the future, that they might not want all these good things. The past half year had not, on the whole, been a flourishing one for gas companies. As a rule, the weather had been everything they did not want, and had affected more particularly seaside resorts like Bournemouth, where the very miserable cold spring and the very doubtful summer prevented the influx of visitors that had been anticipated. Under such circumstances, to be able to report an increase of output of 5½ per cent., and to do this when the consumption had practically doubled in Bournemouth in seven years, he thought presented a satisfactory state of affairs on which they might congratulate themselves. In regard to the water undertaking, the proprietors would be pleased to hear that their new softening plant was now in good order. They would remember the circumstances under which they had to carry out this work; and he hoped that those who wanted soft water were contented and satisfied. The Engineer was now trying to effect certain economies, so as to enable the softening of the water in future to be accomplished at a cheaper rate than in the past. He had spoken a good deal of their new Poole Gas-Works during the last few half years. The preliminary difficulties (which must always occur in large undertakings of the kind) were now at an end; and he was able to report that the works were in absolutely full working order. He could now say they had some excellent works in a good position. They were near both the harbour and the railway, and were therefore in an essentially convenient spot for their work. The proprietors might note one result of the new works in the amount of the wages account. A pleasant incident of the past half year had been the visit of the Southern District Association of Gas Engineers to Bournemouth and to the Poole works. This was due to their Engineer and General Manager (Mr. H. W. Woodall) being the President for the year. Representing the proprietors, the Board welcomed these representatives of the gas industry at Bournemouth, and showed them everything that was to be seen in their gas-works. The visitors carefully inspected the vertical retorts. He was not sure of the nature of all the comments and the results of the inspection; but of this he was certain, that the visitors spent a happy and thoroughly enjoyable day, and he hoped they benefited by seeing the new Poole works. Perhaps he might be pardoned if he mentioned a personal matter. The members of the old South-West of England Association of Gas Managers visited Bournemouth 23 years ago. On that occasion, the visitors were welcomed by his father, who occupied the position then that he (the Chairman) had the honour of representing and occupying on the occasion of the recent visit of the Southern Association. These were pleasant reminiscences for any man; and when he noticed the progress of the Company in the meantime, he thought that the proprietors were to be congratulated. Well, they had now to look to the future. As the proprietors knew, an increase in the price of coal was staring the Company in the face; and the possibility of having to raise the price of gas was before them. But the Directors were hoping—seeing that although they had an advanced price for coal, they had also fortunately a rise in the price of coke, with the increased sale of gas for cooking and heating which they trusted the increased cost of fuel would bring about, and with the larger carry forward—they might be able to breathe for the next twelve months without any immediate prospect of increasing the price of gas. Beyond that, it was impossible to say anything. Sufficient for the twelve months must be the good thereof; and whatever might happen after that, he would only hope they might be able to rise to the occasion. Of this the proprietors might be certain—the Directors would not raise the price of gas if they could possibly help it. It was a curious thing that, instead of raising the price of gas, they were going to reduce it; and in this respect they would be almost unique among gas companies at the present time. Under the Company's Act, it was their duty to reduce the price of gas at Poole by 2d.; and this they were able to do. He hoped their consumers at Poole would take full advantage of the cheap gas, and would remember that, though coal had gone up, gas in Poole at all events would come down. There was one little drawback he ought to mention. It had always been his pride, being a member of the legal profession, to keep down the Company's legal expenses. Unfortunately, they were now in for a fight. He thought it only right to announce that the Company would have to contest the assessments that had been made on their property by the local authorities. The Directors had carefully considered the matter; and they felt bound, in the interests of the proprietors and of the consumers of gas, not to accept the figures that had been suggested to them by the rating authorities. The Board were as anxious as anybody could be to avoid appealing to legal arbitrament; but the figures were so high, and the Company's own figures differed so materially and considerably from those of the local authorities, that he was afraid they must appeal to the Courts, and fight out the question to the very end. The contest would be a friendly one—as friendly as any legal contest could well be. But, from the Company's standpoint, it would be a very firm one, because they believed they were in the right. There was one additional source of profit (he thought he might point out) for the future; and it was a very hopeful one—that was, the gas-heated hot-water systems. They were introducing them into Bournemouth, and introducing them with great success. More than 60 of the boilers had been installed; and they were giving great satisfaction. If they could get 60, there was no reason why they should not get 600, and no reason why some day they should not get 6000. When one looked back, and remembered it was only some fifteen or twenty years ago since gas cookers and fires were freely introduced, it would be recognized that, if they could get gas-heated water-boilers introduced and developed in use at anything like the same rate, there was a wonderful future for this branch of utilizing gas. Though it was in comparatively recent years that gas-cookers had come on, they had now in Bournemouth no less than 14,000 of them; and if among an approximate total of householders of 18,500 they could get 14,000 cookers fixed, he hoped they would be able to increase considerably the number of gas-boilers which had been so successfully started and introduced during the half year.

Alderman S. L. RYMER, J.P., seconded the motion, remarking that the Company was never in a more prosperous condition than now.

Mr. GLEN asked whether the Directors contemplated investing any more of the large reserves they already had outside the Company. There was also the point as to the considerable depreciation the reserve fund investments had suffered recently. If their investments had been sold the previous day, there would have been a loss of about £2000. When the Company were in such a prosperous condition, was it not the opportunity for writing these down? A gratifying point to which reference had not been made was the extraordinary difference in the decrease of gas which was unaccounted for; and it would be interesting to know if there was any special reason for the tremendous saving in gas which had resulted in the past six months.

The CHAIRMAN said, with regard to the reserve fund, they were satisfied to keep it at £50,000, with its automatic increase by dividends at the rate of something like £700 a year, which the Directors thought was at present sufficient to go on with, especially as they were writing-down at the rate of £6000 a year for the old works. As to the proportion of the reserve fund that was invested, it was smaller than they would like. But they had had such large charges for new gas-works, water-softening plant, new well, and so forth, that the Directors thought they could utilize the money better in the business than by making investments outside. Now that the time had come when there would be a suspension of these large expenditures, the Board would reconsider the reserve investments. He was glad to hear the depreciation of the investments was only £2000, and the question of writing them down should have the attention of the Board.

The ENGINEER (Mr. H. W. Woodall), replying to the question as to the reduced leakage account, said that the proprietors would always find in this, as in other gas companies, the leakage was always smaller in the summer half of the year than in the winter one. It was to a certain extent a question of meter-reading. There was a bigger consumption going on at the time of meter-reading in the winter half, and the leakage was effected. The leakage was brought down in the summer half by, as a rule, nearly 1 per cent., but not nearly to the extent it appeared to be down this half year. If they averaged the two half years, however, it would be found to be at about 5 per cent.

The motion was unanimously carried.

Mr. R. HESKETH JONES moved the declaration of dividends at the rates per annum of 14 per cent. on the original shares, 7 per cent. on the "B" shares, and 6 per cent. on the preference shares—all less income-tax. He remarked that, though the dividend appeared to be high, commencing with 14 per cent., still on the average it was only 5½ per cent. on the capital actually subscribed by the proprietors. Personally, he was not quite so sanguine as the Chairman as to the avoidance of an increase in the price of gas for twelve months; and he hoped his remarks would not be construed into a pledge. Their reserve fund was not so very large to meet the extraordinary increase in the price of coal, which was equal to no less than 4d. per 1000 cubic feet. He had had experience with a water-circulating gas-boiler, and found it very effectual and convenient.

Mr. ERNEST L. BURTON, in seconding, emphasized what Mr. Jones had said as to the low *pro ratâ* dividend that was paid. The Company were singularly fortunate in having such a low basis of dividend. This resulted from the amount of premium capital, which stood at no less than £160,653 on the shares.

The motion was unanimously carried.

Proposed by Mr. BURTON and seconded by Mr. GLEN, a hearty vote of thanks was passed to the Chairman and Directors and officers.

The CHAIRMAN responded for himself and his colleagues; and then referred to the appreciation of the Board of the efforts put forth by their executive officers, the staff, and the workmen.

Mr. CASH, having acknowledged the vote, referred to a somewhat novel feature in the accounts. The motive power, he said, used at Poole was electricity generated by gas-engines; and, in consequence, a large quantity of gas was consumed on the works compared with the usual allowance of 1 per cent. Therefore special entries had been made in the accounts for this. This was a practice he hoped other gas companies would follow where gas was used largely for power on the works. He also referred to a visit the Lighting Committee of the Corporation paid to the Poole works, and in conjunction with which the Town Clerk had written thanking the Company for the courtesy shown them. He (Mr. Cash) thought he might say the visit of the Committee confirmed their impression that the Company were doing their best in the interests of Bournemouth.

Mr. WOODALL also responded for himself, his staff, and the workmen; and the proceedings then terminated.

PROVINCIAL GAS COMPANIES.

Meeting the Increased Cost of Coal at Barnsley.

At the annual meeting of the Barnsley Gas Company on Monday last week, the accounts presented showed a balance of £5144 available for distribution; and the Directors recommended that, in addition to the interim dividend paid on the 1st of March last, a further dividend should be paid of 5 per cent. on the general capital stock and "F" shares, 3 per cent. on the "C" (preference) shares, and 3½ per cent. on the "D," "E," and "G" shares, less income-tax in each case. In moving the adoption of the report, the Chairman (Mr. E. G. Lancaster, J.P.) stated that the cost of manufacture of gas had increased by £714, of which £620 was owing to the rise in the price of coal; £1267 had been saved on distribution—accounted for by the fact that the repairs had been light. On the total expenditure there was a

decrease of £735. On the other side, the most satisfactory feature was the increase of 4 million cubic feet of gas sold; and, exclusive of the public lighting, there was an increase of £567. Unfortunately, this was reduced by the lower value of the residual products; leaving only £2000 increase. Altogether, he considered the figures were satisfactory; but the coming year was causing some anxiety. The Directors had accepted their coal tenders, and they knew they were going to have to pay £2000 extra for coal. It was the sudden increases in the price of coal that made it difficult work for gas companies to arrange their figures so as to be satisfactory to both sides. He had a list of 34 gas companies who had increased their price from 2d. to 9d. per 1000 cubic feet, owing to the higher coal bills. The Directors did not propose to raise their price; but they would have to temporarily suspend the sliding-scale of discounts. He looked upon the discount system as being rather an advantage, in that, should times require it, if the price of coal went up, the scale must come down, and if coal went down the scale would go up. Therefore he considered it was fair for both sides. The motion was carried.

A Favourable Report from Cork.

At the half-yearly meeting of the Cork Gas Consumers' Company on Friday, the Directors reported that the accounts for the six months ending the 30th of June showed a small decrease in the rental compared with the first half of 1906; but it was confined to the March quarter, and was principally on the consumption for gas-fires, owing to the unusually mild weather which prevailed. The returns from residuals had increased; and this compensated for the diminished rental. The total revenue for the half year was £26,553, and the expenditure £19,193; leaving a balance of £7360. The balance on the profit and loss account, after placing £302 to the depreciation fund, was £5955, out of which the Directors proposed to pay a dividend at the rate of 8 per cent. per annum. This would absorb £5555, and leave £400 to be added to the reserve fund. In a report appended by Mr. R. Bruce Anderson, he mentioned that all the gas was now being made by the new gaseous settings erected by Messrs. Gibbons, which were working economically. In moving the adoption of the Directors' report, the Chairman (Mr. George Lynch) remarked that, notwithstanding the very severe competition the Company had had to contend with, the number of the customers continued to increase, and they had now in use altogether 7999 meters, prepayment and ordinary. For some months past they had been making their entire supply of gas in the new retort-house with the settings referred to by Mr. Anderson; and though the cost of labour was higher, the increased production of gas compensated for this, and the results were satisfactory under present conditions. In most other cases where these settings were in use the charging and drawing of the retorts and the handling of the coal and coke were done by machinery. This, however, the Directors had no desire to employ, so long as the work was done by hand labour on reasonable terms. He was sorry to say there had been a large advance in the price of coal. After delaying for some months in the hope that it might be only temporary, the Directors had to follow the example of the large English gas companies, and contract for their winter supply at much more than they paid last year. There seemed to be no sufficient reason for so great an advance; and they hoped that before the next meeting there would be some prospect of a return to lower prices. Mr. Mahoney seconded the motion, and it was carried.

An Extended Area at Maidstone.

Under the Act obtained by the Maidstone Gas Company in the present session, their area of supply was extended by the inclusion of several parishes; and, in exercise of the powers conferred upon them, they have agreed to purchase the undertaking of the Sutton Valence Gas Company on the 1st of October next, and connecting mains are now being laid between Leeds and Sutton Valence. Recent extensions to rural parishes continue to show favourable results; but, owing to the large increase in the cost of coal, the Directors have felt it right to raise the price of gas from 2s. 4d. to 2s. 6d. per 1000 cubic feet, as from Midsummer, 1907. The business in the year ended June 30 increased satisfactorily; and the accounts for this period, which were presented at the recent annual meeting, showed a sum of £13,209 available for distribution. Out of this, the Directors recommended the payment of a dividend (less income-tax) of £3 16s. 3d. per cent.; making with the interim dividend £7 12s. 6d. for the year. In moving the adoption of the Directors' report, the Chairman (Mr. George Marsham) referred to the outstanding feature of the year's work—the enlargement of the area of supply. He said the supply obtained from the villages which were already furnished with gas, though in some of them the business was not yet fully developed, quite came up to the estimate; and the Directors had every reason to believe that the new districts would be equally satisfactory. The steady growth of the business of the Company would be best gathered from the figures he would quote. The length of mains now supplied was 63½ miles; being a growth of 3½ miles during the year. The gas sold showed an increase of 6½ million cubic feet, or 2¼ per cent. Of this increase, 5 million cubic feet had been obtained from the extensions made since 1903 to the surrounding villages; and the remainder showed that the Company more than held their own in the borough. The sum received for gas had increased by £939; and that for the hire of meters, stoves, and fittings by £285. The receipts for residuals, owing principally to the low price obtained for tar, had decreased by £241. The number of consumers had augmented by 432 during the year; the total number being 3464 ordinary, and 5607 prepayment. The number of cooking-stoves on hire was 6001, and of heating-stoves 1212—being increases of 307 and 65 respectively; and the Company's workmen now maintained 5174 incandescent burners. An important addition which the Directors were now introducing in the works was an oil-gas plant. This would, it was believed, result in economy in the production of gas, and would ensure a sufficient supply throughout the extended area during the winter months. The Directors had always taken some pride in the fact that the price of gas had been for many years the lowest in Kent outside the Metropolitan area; and though they had had to advance it 2d. per 1000 cubic feet as from Midsummer last, owing to the largely increased cost of coal, they believed this small addition still left it as cheap as it was in any other Kentish town. In conclusion, the Chairman referred to the satisfaction the staff and employees had again given the Directors. Dr. Hoar, in seconding the motion, expressed the opinion that the extensions would eventually be of great benefit to the shareholders. The report was adopted.

An Excellent Half Year at Normanton.

In the report which the Directors of the Normanton Gas Company submitted at the recent half-yearly meeting, they stated that the profits for the six months ending the 30th of June amounted to £1809, and that there was a sum of £3443 available for distribution. They therefore recommended dividends of 5½ per cent. on the original, and 4 per cent. on the additional stock. In moving the adoption of the report, the Chairman (Mr. E. Mitchell, J.P., of Ossett) said the consumption of gas during the half year showed an increase of more than 5 per cent., and the working had been successful in every way. One most satisfactory feature was a reduction in the leakage; and the Directors hoped to be able to improve on this in the future. They had now to face the high price of coal; the new contracts having been made at a largely-increased figure. They hoped, however, by the improvements in the works which had been made from time to time, and a saving in leakage, that it would enable them to meet the present advance without having to raise the price of gas, which the Board would be most reluctant to do. Having referred to the principal items of expenditure, the Chairman said the total was £2957. The income from gas was £255 more, and from residuals £28 more, than a year ago. The total income was £4766; being an increase of £284. The fund available for dividend was, he thought, the largest they had had for some years. They had had an excellent half year. The report was adopted.

An All-Round Increase at Portsmouth.

The half-yearly general meeting of the Portsea Island Gas Company was held last Saturday, under the presidency of Alderman Sir John Baker, M.P., J.P. In their report, the Directors stated that, exclusive of the amount standing to the credit of the extraordinary renewals account (£9200), the profit and loss account showed an available balance of £44,040, out of which the payment of dividends at the following rates was recommended: 13 per cent. on the "A" and "B" shares, 12 per cent. on the "C" shares, 10 per cent. on the "D" and "E" shares, and 5 per cent. on the stock (all less income-tax); leaving a balance of £26,108 to be carried forward. The Directors added that both the number of consumers and the quantity of gas sold continued to increase; and that the efficiency of the manufacturing and distributing plant had been fully maintained. The accounts accompanying the report showed that the revenue for the half year ending the 30th of June amounted to £108,023, compared with £99,919 in the corresponding period of last year; and the expenditure was £88,875, against £81,006. The balance carried to the profit and loss account was consequently £19,148, as compared with £18,513. In the manufacture of gas during the half year, 55,532 tons of coal and cannel were used, together with 385,507 gallons of oil. The gas made amounted to 649,940,000 cubic feet, compared with 627,720,000 cubic feet before; the quantity accounted for, to 622,364,800 feet, against 599,729,100 cubic feet in the first half of 1906. The total of the reserve fund was £54,751, and of the insurance fund £16,865. In proposing the adoption of the report, the Chairman said that under every head there had been an increase, and the Company were now realizing the benefits which their new works had prospectively given them long ago, thanks to the skill and energy of their Engineer and General Manager (Mr. J. D. Ashworth), who never lost an opportunity of adapting improvements. The Company had recently fitted the Southsea Clarence Pier with gas, which had given satisfaction to everybody; and they had during the half year increased their consumers in the borough by 1980. Mr. R. E. Hellyer seconded the motion. In the subsequent discussion, a shareholder suggested that much satisfaction would be given if the rental of meters were abolished, seeing that the Borough Electric Light Committee had devoted £900 per annum for a similar purpose to the users of the electric light. Alderman Power said the consumers of electricity and of gas were on very different footings—the former being liable for a minimum consumption of 7s. 6d.; and the Chairman spoke of the economy of gas as compared with the electric light, in connection with which he mentioned that by the newly-introduced gas methods he had superseded the electric light in his own Brighton establishment—the cost now being only one-third of that formerly borne by his firm. The motion was carried.

Dearer Coal Causes Higher Price at Sutton.

The Sutton Gas Company have declared a dividend of 6 per cent. for the past half year; but as dearer coal has caused an increase of 2d. per 1000 cubic feet in the price of gas, the dividend will, by the operation of the sliding scale, be reduced in future. Among the receipts for the six months were £11,715 from the supply of gas, and £4217 from the sale of residuals. The expenditure was £13,933; and the profit of £3468 brought up to £12,896 the balance on the profit and loss account.

Increased Sale of Gas at Wakefield.

Dr. W. A. Statter, the Chairman of the Wakefield Gas Company, presided at the ordinary half-yearly meeting on Monday last week, and in moving the adoption of the report said the working in the six months ending the 30th of June had been successful; the quantity of gas sold showing an increase of 5·27 per cent. The dividend required had been earned, and a good balance was carried to the next account. Despite the fact that the price of coal had much increased, the Directors hoped to be able to pull through without advancing the price of gas. Mr. G. A. Moorhouse (Vice-Chairman) seconded; and the motion was agreed to. The accounts accompanying the report showed that the revenue in the half year was £23,867, and the expenditure £15,698; leaving a balance of £8169 to go to the profit and loss account. The balance available for distribution was £11,389; and it was resolved to pay 4½ per cent. dividend on the preference stock, 5¾ per cent. on the £25 and £5 shares respectively, 4½ per cent. on the £5 "B 5th" shares, and 4½ per cent. on the new ordinary £10 shares. The customary vote of thanks to the Chairman and Directors was passed unanimously. In responding, the Chairman moved, and the Vice-Chairman seconded, a vote of thanks to the Engineer and Manager (Mr. H. Townsend), the Secretary (Mr. W. H. Parker), and their respective staffs, which was cordially approved and suitably acknowledged.

GAS LIGHTING IN THE METROPOLIS.

[From the "Joint-Stock Companies' Journal," Aug. 21.]

Steadily as time goes on, the quantity of gas used for public and private purposes increases. The slot meter, incandescent mantle, and other devices which have done so much to place the industry on a broader and safer basis, have now been sufficiently long in use for their initial effects to have worn down to the normal; so that it can be seen, by a simple comparison of figures, that the enlarged consumption recorded in recent accounts is not the outcome of tapping new classes, but is the natural and satisfactory effect of growth of an ordinary, as contrasted with an extraordinary, kind. For the purposes of the present examination, we set side by side some of the principal points in the accounts of nine Companies, whose combined area is very great, and is worked and dwelt in by the people of London. They are the Brentford, Commercial, Croydon, Gaslight and Coke, South Metropolitan, South Suburban, Tottenham and Edmonton, and West Ham Companies; and the accounts dealt with are those covering the half year to June 30, 1907, and the corresponding divisions of 1905 and 1906.

In the half year ended June 30, 1905, these nine Companies sold 21,383,819,000 cubic feet of gas for lighting, heating, and cooking purposes to private consumers and for public uses; their revenue from all sources was £3,658,213, and their profit £889,282. In the first six months of the following year, the sales were 22,286,439,000 cubic feet, the revenue receipts were £3,787,119, and the profit was £976,996. In the past half year the output was 23,136,458,000 cubic feet, the revenue £4,070,460, and the profit £1,059,281. There is no need to insist upon the proof afforded by these figures that London is using more and more gas, giving the makers more and more profit. Going a little further into details, however, it becomes evident that it is not the gas consumer who has provided the whole of the increase of gross and net revenue. In the 1905 period, £2,732,592 of the total income took the form of actual payment for gas supplied, £133,161 was paid by way of rental of meters, stoves, &c., £765,444 was secured by the sale of residual products of manufacture, and there were other incidental receipts. In the next period referred to, only £4000 of the increase came from residuals—sales and rents providing the remainder; for gas was cheaper in one or two cases, and the sales were substantially greater. But in the first half of 1907, when the total income was enlarged by £283,000, as much as £123,000 of it fell under the head of residual sales; for as the price of coal advanced, so did the value of coke and other bye-products.

The average price realized for gas in the early part of 1905 was 2s. 6·6d. per 1000 cubic feet, including public lighting, after deducting discounts. To this the proceeds of the sale of residuals added 8·6d. per 1000 cubic feet, against which may be set, by way of contrast, the cost of raw materials for manufacture, which was 1s. 1·8d. per 1000 cubic feet. Other manufacturing charges amounted to 8d., distribution of gas and the care of public lamps cost 4·5d., rates and taxes (with an insignificant sum for rents) absorbed 2·6d., administration cost 1·9d., and the profit (10d.) makes up the total income, which was equal to 3s. 5·1d. per 1000 cubic feet of gas sold. The discrepancy of 0·3d. is explained by co-partnership payments by the Commercial, South Metropolitan, and South Suburban Companies. In 1906 the average figure realized for all the gas that was sold, whatever its purpose, was 2s. 6·7d., or a shade more than in the corresponding period; and as residuals were not so good, at 8·3d. per 1000 cubic feet sold, the total income works out at 3s. 4·8d., including sundries. This amount was dispersed as follows: Coal and oil, 1s. 1·5d.; other manufacturing charges, 7·7d.; distribution, &c., 4·5d.; rates and taxes, 2·5d.; administration, 1·8d.; profit, 10·5d.; payments under co-partnership schemes, 0·3d. It will be noted that raw materials for the manufacture of ordinary coal gas and carburetted water gas cost slightly less, measured by the sales, in the earlier part of 1906 than in 1905, and the profits were on a somewhat higher scale. When we come to examine the figures for the first half of 1907, however, we are faced by some rather striking contrasts. The total receipts were equal to 3s. 6·2d. per 1000 cubic feet of gas sold, the sales themselves producing 2s. 6·5d. and residuals 9·3d. That is to say, gas was cheaper, but residuals were a very much more valuable source of income than in either of the two corresponding periods. The advantage, however, was swallowed up in the advance of the cost of coal to 1s. 2·6d. per 1000 cubic feet sold; other manufacturing expenses were 7·2d. (a useful saving); distribution cost 5d., rates and taxes 2·4d., and administration 1·7d.—leaving a profit of 11d. (after deducting 0·3d. for profit-sharing), which makes the half year undeniably satisfactory in all respects. The greater cost of the coal and other materials, however, cannot fail to have a serious effect upon the results of the current half year. Until 1907 had well begun, coal was coming in under old contracts at relatively low rates; yet we see that the average payment for raw materials was 1d. per 1000 cubic feet in advance of the corresponding period. As the new contracts will apply to the whole of the half year now proceeding, we must be prepared for greatly enhanced working charges, the certainty of which has caused prices to be advanced to private users by the Companies which account for the great bulk of London's gas supply.

There is one item to which, in conclusion, special attention may be drawn; it is rates and taxes. It will be noted that about 2½d. per 1000 cubic feet which consumers pay ostensibly for gas actually passes to the coffers of public bodies in the shape of rates and taxes; that, in fact, upwards of 8 per cent. of the proceeds of gas sales are so absorbed. In other words, out of every sovereign paid by the consumer for his gas supply, something like 1s. 7¾d. is disguised taxation. And it really comes from the pocket of the consumer, not from that of the stockholder; for if it ceased, and gas were cheapened, the proprietor would benefit, but the sliding-scale will not allow him to receive more unless and until the consumer pays less. This indirect collection of rates (taxes, which we cannot separate, are different) is really bad, because the ratepayers never know what they are actually paying; and there is obviously a great deal in the plea of the South Metropolitan Company that the basis of assessment should be made plain, in justice not to gas investors alone, but to gas users—that is, to everyone.

THE INCREASED PRICE OF COAL.

As briefly recorded in our "Editorial Notes" last week, Mr. A. Fell, the Member for Yarmouth, called the attention of the Chancellor of the Exchequer, on Monday last week, to the statement of Sir George Livesey, at the meeting of the South Metropolitan Gas Company, to the effect that the abolition of the export duty of 1s. per ton had unduly raised the cost of coal, and had increased the foreign demand for it, to the detriment of the industries of this country, and he asked whether, having regard to the price of coal likely to prevail during the coming winter, and to the hardship this would entail, he would consider Sir George's suggestion to impose an export duty of 2s. a ton, so as to put some check on excessive export. Mr. Fenwick, the Labour Member for the Wansbeck Division of Northumberland, followed with another question—viz., whether Mr. Asquith was aware that the cost of coal at the pit mouth was only 8s. 5¾d. per ton, and that the excessive price which the consumer had to pay was due to the action of the middleman taking advantage of the excessively cold summer to keep up the winter prices throughout the season. Mr. Asquith said he was not able to answer the latter question without making inquiries; but he had no doubt the hon. member was accurate. In reply to Mr. Fell, he said his attention had been called to the statement referred to, but he did not concur in it; and he was not prepared to consider the reimposition of the duty, either at 2s. a ton or at any other rate. The reply was received with cheers.

"The Times" on Tuesday contained the following letter from Sir George Livesey on the subject of Mr. Fenwick's question: "Mr. Fenwick is reported in 'The Times' of to-day as saying 'that the cost of coal at the pit mouth was only 8s. 5¾d. per ton, and that the excessive price which the consumer had to pay was due to the action of the middleman taking advantage of the excessively cold summer to keep up the winter prices throughout the season.' This is an excessively weak excuse for the high price of coal, and can only be regarded as a 'terminological inexactitude,' or at least as very misleading. I do not know where Mr. Fenwick gets his very exact figure of 8s. 5¾d., but suppose it must be some past average, which certainly does not give the present position correctly; and it is unjust to the middleman. I do know that this Company [the South Metropolitan] in 1905 made contracts for over a million tons of Newcastle coal at 7s. 6d. a ton free on board in the Tyne; the price used to be about 6s. 6d. In 1906 we paid 8s. 6d.; and in April, 1907, the price was 11s. 6d. a ton. In 'The Times' Financial and Commercial Supplement of yesterday there is this statement dealing with Newcastle coal prices: 'Current quotations are: Best steams, 16s. 6d.; seconds, 15s. 6d.; smalls, 10s. to 10s. 6d.; best gas coal, 15s. 3d. to 15s. 6d.; seconds, 13s. 9d. to 14s.; Durham bunkers, 14s. 6d. to 15s.; coking coals, 14s. 6d.; households, 15s. to 17s. 6d.' Your figures for gas coal correspond with prices recently asked of us. All the above are f.o.b. prices, being direct dealings without the intervention of a middleman. There is a deduction to be made for carriage from the pit mouth to the ship; but, with that off, Mr. Fenwick's figure of 8s. 5¾d. is still inexplicable. I have been told that the North-Eastern Railway Company charge up to 1s. 6d. per ton; but where a colliery has its own railway the cost is less. Your reports from all the other coal districts show that the price has risen considerably in the last three or four months, and that further advances are expected. The fact is, there is an active home and a very active foreign demand for our coal, which (especially the latter) has enabled coal producers to raise prices excessively, to the detriment of all home industries and the domestic users of coal."

The member of a large wholesale firm stated in the course of conversation with a representative of the "Daily Telegraph" that the maintenance of the foreign demand for British coal and the impending rise in wages were alike responsible for the present situation. "Owing," he said, "to the inability of the Westphalian Syndicate to supply its own wants locally, Germany is buying very largely from us, not only in steam-raising coal, but in all the better-known household varieties." "Do you think," he was asked, "that the abolition of the export duty on coal is a factor in the present situation?" "I am inclined to think not," was his reply. "The fact is," he added, "that if there had been an export duty of even 5s. a ton, the Germans would have been compelled to take our coal just the same. You see what we might have been reaping from the foreigner." "And now about the prospects of the householder?" was another question. "Well," was the reply, "so long as this foreign demand continues, I do not see how low prices are ever to rule; and I really believe that before the winter is over we shall witness a return to the prices of 1900, when certain classes of coal sold at as high as 35s. a ton. You see that in connection with this matter of foreign exports we have not only to reckon with the requirements of European countries. We have to remember that as new countries are being opened up to railway communication, the demand from abroad will tend to increase, as ours is, roughly speaking, the only coal which these countries can obtain. The householder's chief hope lies in a slackening of the present German demand."

Speaking to a representative of the "Standard" last Tuesday, Mr. F. B. Cameron, of Messrs. Cameron and Co., expressed the opinion that the present state of affairs had been brought about mainly by the abolition of the tax upon exported coal, coupled with the great boom in trade upon the Continent. "It is a question now of getting coal from anywhere," said Mr. Cameron. "It all seems to have been bought up by foreign firms; and all our ports are congested with loads for Germany, France, Russia, and other countries. In fact, there are not ships enough to carry it away at once, and quantities are now lying at the docks waiting for shipment. The action of the railway companies in carrying only the exact weight of coal, instead of allowing for wastage as previously, and the institution of the eight-hour day, have also been important factors in bringing about the state of affairs which now exists; and, of course, the mineowners, no doubt, feel that they must protect themselves on account of the gradual rise in the wages of their employees. The increase in price affects every kind of coal, and I cannot say what it will reach in September, as it is a question of the quantity available. It is safe to say that coal will be dearer this year than, or, at any rate, as dear as, it was during the South African War."

ZURICH GAS SUPPLY.

Report of the Zurich Gas-Works for the Year 1906.

The report for last year of the Zürich gas undertaking, of which we have received a copy from Herr Weiss, the Engineer, is as interesting as the earlier annual reports of which summaries, such as the following, have appeared from year to year in the "JOURNAL."

The extension of the large gas-works at Schlieren, of which a description has already been given, proceeded during the year; but delays occurred, partly owing to the subsoil proving very bad for foundations in certain places, and partly owing to scarcity of hands. There have been completed the foundations for two benches of vertical retort-settings and for a chimney for them; and there are in hand an iron-work retort-house, a coal-store in iron and concrete, a gasholder of 50,000 cubic metres (1,765,000 cubic feet) capacity, and some smaller structures.

The gas made amounted to 23,344,700 cubic metres (824,442,000 cubic feet)—an increase of 9·45 per cent. on the make in 1905. There were carbonized 76,593 metric tons of coal and 964 metric tons of cannel; and the average make of gas per English ton was 10,801 cubic feet—about 25 cubic feet less than in the preceding year. There was again a slight decrease in the price paid per ton of coal. The average weight of the charge per retort was 392 lbs. Of the total make of gas, 55·29 per cent. was sold for heating and cooking purposes, 2·74 per cent. for power, 18·78 per cent. for lighting (private consumers only), and 9·61 per cent. for public lighting. These figures refer to the town district; 2·94 per cent. of the gas made being delivered to suburbs. The unaccounted-for gas amounted to 4·36 per cent. of the make. There was a slight falling off in the quantity of gas consumed for power purposes.

The following table shows the average yields of bye-products in 1906, stated in percentages of the weight of coal carbonized:—

Coke	73·3670	Producer clinker	3·6800
Ammonia	0·1975	Retort carbon	0·0930
Tar	6·3180	Prussian blue from sludge	0·0829
Thick tar (pitch)	0·3660	Naphthalene extracted by oil-washing	0·0313

The yields of coke and ammonia were appreciably higher than in the preceding year.

The number of burners in street-lamps increased from 7315 in 1905 to 7466 last year. The street lighting was almost wholly by incandescent burners—there being now only 50 of the flat-flame kind. The average number of mantles used per burner in the year was 4·96, and of chimneys 2·42. Besides the ordinary burners, there were 21 Lucas lamps and 6 "Millennium" lights. The price of gas for lighting purposes was reduced on Oct. 1 from 25 c. to 22½ c. per cubic metre (the price is about 5s. 1d. per 1000 cubic feet). Daily tests of the gas were made for calorific power, illuminating power, and sulphuretted hydrogen. The net calorific power of the gas averaged about 569 B.Th.U. per cubic foot at 60° Fahr. and 30 inches. The net profit on the year's working was 951,646·81 frs. (about £38,066).

AMERICAN VIEWS OF MUNICIPAL OWNERSHIP.

In the "JOURNAL" recently (*ante*, p. 436), reference was made to the investigation into the subject of municipal trading carried out by the Commission on Public Ownership and Operation of the American National Civic Federation, and to their reports thereon. Labour conditions and the character of the gas, water, and electric service rendered by public and private plants are covered by the official reviews which have been made public up to the present time. The Commission appointed a Committee of Investigation of 21 members, who engaged in turn a staff of engineers, accountants, and statisticians to examine thoroughly every undertaking in America and Great Britain visited by the Committee. These experts were so chosen that, in each examination made, both sides of the municipal ownership question were represented. Thus, one engineer, accountant, or statistician approached the subject under consideration favourably disposed towards municipalization, while his colleague began his task holding views in opposition to this principle. Our contemporary "Engineering Record" gives some extracts from the reports of the Committee; and we take therefrom the following particulars on matters of interest to our readers.

The labour conditions under private and public ownership are discussed by Professor John R. Commons, of the University of Wisconsin, and Mr. J. W. Sullivan, the Editor of the "Clothing Trades Bulletin." Starting with the same information gathered by the experts as a basis for argument, the former arrives at the conclusion that corruption under municipal control is no greater than under private ownership; while the latter makes caustic reference to political rottenness, which he declares to be evident in Syracuse, Allegheny, and Wheeling. According to Professor Commons, the investigations have shown that the strongest safeguard for a manager against the pressure of outside recommendations is the recognition of organized labour within its department. He says that wherever they found a class of employees organized and dealt with as such through their representatives, the positions were exempt from politics. He thinks this follows from the nature of labour organization, which cannot survive if individuals are given preference on political, religious, personal, or any other grounds than the character of the work they do. Even in the politically honeycombed municipal undertaking at Allegheny, the union of electrical workers stopped the practice of paying assessments by its members for political campaigns. The success of the civil system of Chicago is considered to be due more than anything else to the fact that organized labour has one of the three members on each examining Board. The Manager of the Manchester tramways ascribes his freedom from interference by individual councillors to his recognition of the Trade Union that contains 90 per cent. of his motor men and conductors. The minimum payment for common labour by the private companies in the United States, except in Atlanta, is lower than that of the cities investigated; and the hours of labour are longer. The labourers employed by the municipalities are in all cases citizens; but most private companies employ foreigners when coloured labour is not available.

Mr. Sullivan sums up his observations with the conclusion that in all but the most poorly paid forms of labour, and for tramway employees, municipalization has not raised the wages or improved the working conditions of the employees above those in the private undertakings. With respect to "common, unorganized labour," however, the investigators found a difference rather favourable to British municipal employees. The report cites two causes for this condition—first, that the municipal labourer is a picked man; and, secondly, that this class of labour is capable of exerting on city councils a combined pressure which obtains for them better terms than the employing councillors accord to the men they hire in their private capacity for similar work. Mr. Sullivan says no street car undertaking in Great Britain has ever been a "private" enterprise in the sense in which the word is applied in America. "The twenty-one years' term of the franchise, the veto of company petitions by village authorities, the enormous cost of parliamentary powers and local assents, and various other restrictions non-existent in the United States, shackle and impoverish British tramway company management, and consequently forbid an intelligent investigator employing British example to illustrate possibilities in America through change from private to municipal ownership. British tramways have always been semi-municipal. As by the terms of their franchises all English tramway undertakings may be taken over by the municipalities, the Directors manage their properties with this end in view. Compared with the remarkable changes for the better in wages and hours in the American street-car industry under companies, the best of the British municipal labour improvements seem hardly more than trivial."

The reports of the investigating staff for water and lighting plants have been reviewed by Vice-President Walton Clark, of the United Gas Improvement Company, President Charles L. Edgar, of the Edison Electric and Illuminating Company, of Boston, President Frank Parsons, of the National Public Ownership League, and Superintendent Edward W. Bemis, of the Cleveland Water-Works. The experts examined the public gas-works at Wheeling, Richmond, Holyoke, and Westfield, and the private gas plants at Atlanta, Norfolk, Philadelphia, and Fitchburg and Beverly; also the municipal water-works at Cleveland, Chicago, and Syracuse, and the private water-works at New Haven and Indianapolis; the public electric light and power plants at Chicago, Allegheny, South Norwalk, Detroit, and Danvers, Holyoke, Taunton, Chicopee and North Attleborough, and other places, and the private lighting plants at Northampton, Fitchburg, Salem, Beverly, Gardner, Abington, and Attleborough.

The Wheeling gas plant is severely criticized by Messrs. Clark and Edgar; while the plants at Norfolk and Atlanta are regarded as satisfactory. They say: "If we consider together the price the Wheeling consumer pays for gas and the character of the service rendered, we may not doubt that he gets less of net result per dollar expended than does the gas consumer in Atlanta or Norfolk. Low and varying pressure, uncertain candle power, influenced at times by a dash of natural gas (at Wheeling), will bring troubles to studying children that, while not factors in financial calculations, have a proper place in this inquiry. Wheeling's gas plant is not an important factor in the well-being of Wheeling's citizens. What with fast meters, charges for service and meter setting, absence of any gratuitous work, the admixture of 15 c. 8-candle power natural gas, insufficient and irregular pressure, and general inefficiency in the complaint department, Wheeling gas is a dear commodity at any price. Our experts found nothing to praise in Wheeling's service, and little to criticize in the service of the Companies at Norfolk and Atlanta."

Mr. Bemis, on the contrary, holds up the Wheeling plant as an example of what may be accomplished by a municipality, even under unfavourable political conditions. Despite its admitted defects, he says the Wheeling experiment has been a financial success, and has been "the pioneer throughout the United States in low charges." He does not agree with Mr. Edgar and Mr. Clark as to the value of the free installation by the private Companies at Atlanta and Norfolk, saying on this point: "The gas sold in Wheeling during the sixteen months ending May 1, 1905, was 162,515,200 cubic feet. The difference between the price charged at Wheeling, 75 c., and at Norfolk and Atlanta, $1, or 25 c., multiplied by these sales, would be $40,628. In other words, the saving to the consumer in the price of gas in less than one year will cover all the difference between the free services and the meter setting from the kerb to the house in Atlanta and Norfolk, and the cost of the same at Wheeling."

There is the same difference of opinion concerning the Philadelphia Gas-Works. Messrs. Edgar and Clark quote Dr. L. S. Rowe as the authority for the statement that the quality of the gas supplied has been improved by the Company now operating the service, and that through the rental paid the city has received for eight years an average profit of $491,674 annually; while for the last few years under city operation there was a loss of $245,398 per year. The private Company, however, charge no more than did the City; but they supply better gas. "The Commission's records," say Messrs. Edgar and Clark, "indicate a high degree of efficiency in the Company operation of the Philadelphia Gas-Works, and kindly and liberal treatment of the employees." On these latter points, Dr. Rowe speaks as follows: "As has been shown, under municipal management there were abuses in almost every branch of the operation. The purchase of coal and the residual products were each under the control of favoured individuals; and the wages account was padded with incompetents, the friends of men prominent in city politics. It is unquestioned that there were leaks in the management of the gas-works at other points than the distributing system. It is true that the labour account was debauched; and it is certain that in the purchase and sales departments there were influences at work which worked harm to the City's interests. But the loss through such sources was inconsiderable when compared with those inflicted by councils by the senseless blocking of the way to improvement in cutting off the appropriations for modernizing the plant. During the entire period of municipal operation the officers in charge were engaged in a losing fight to preserve the works from ruin. There never was a time, during

the entire period of responsible control, when it could truly be said that the works were in an efficient condition."

Professor Parsons claims that the experience at Philadephia is of no value in settling the problem of municipal ownership. He says it does not appear that Philadelphia ever had real public ownership of the gas-works, but only government ownership, which is not public ownership, unless the people own the government. "Philadelphia had the paper title to the gas-works; but the people did not own or control them, because they did not own the city government. The councils were full of the agents and allies of the private street railway, telephone, gas, and electric light interests; and they purposely mismanaged the gas-works, allowed them to be filled with supernumeraries, and let them get out of repair by refusing year after year to appropriate, even out of the receipts of the plant itself, the money necessary to keep it in order, so that they might have an apparently good excuse for executing a lease of the works to themselves. Philadelphia did not have real public ownership of gas, but one of the worst forms of private ownership—ownership by political grafters, in the pay of corporations, but masquerading as public servants."

With regard to water-works, Messrs. Edgar and Clark summarize the reports of the experts regarding the quality of the supplies in the cities previously mentioned as follows: "This phase of the question may be summarized with the statement that while the natural conditions in the different cities call for different methods of treatment, it is evident that the two Companies examined were more solicitous regarding the purity of the water supply, and adopted more thorough means for ensuring the same, than did the three municipalities who ran their own water department." The conclusion drawn as a result of the investigation into the quality of the water is that that supplied by the two Companies is good; that its quality is much better than that of the water supplied in Chicago; somewhat better than the Cleveland water, and quite as good as that at Syracuse. The latter place has its water from a source which, down to the date of the report, had remained pure without any special expense or effort on the part of the Water Department. It seems that the citizen obtains the cheapest water in Cleveland; while New Haven stands second. At Indianapolis, the poor man gets water fairly cheaply; but the cost increases rapidly as the class of dwelling improves. At both Chicago and Syracuse the poor man pays a high price for water.

Mr. Bemis, on the other hand, quotes the following typhoid fever death-rates as proving that municipalities are furnishing good water, as the lowest rates are in cities with public plants:—

	New Haven.	Indianapolis.	Chicago.	Syracuse.	Cleveland.
1905. . . .	42·8 ..	30·2 ..	16·5 ..	7·1 ..	14·9
1906. . . .	52·0 ..	34·2 ..	18·1 ..	9·2 ..	20·2
Average . .	47·4 ..	32·2 ..	17·3 ..	13·2 ..	17 6

In reviewing the charges for water, he states that the rates are more favourable to the consumer with municipal plants; and he particularly commends the low meter-rates at Cleveland. He also declares that, in spite of great reductions of rates in Syracuse on going from private to municipal ownership, and the phenomenally low charges for all residence consumers under the present meter system in Cleveland, and the moderate charges also in Chicago, the financial results of municipal ownership, from the standpoint of the community and the taxpayer, are far better in the three municipal plants than in the case of the two private Companies studied.

The municipal electric plants are criticized in various adverse ways by Messrs. Clark and Edgar. They state that the Municipal Lighting Department of Chicago is run at an annual loss of $11·07 per lamp, though the authorities claim that they make a profit; that the character of the South Norwalk plant is such that the current costs 20 per cent. too much; that the Detroit plant is old and incapable of expansion; and that the Allegheny plant is poorly designed, inefficient, and expensive to operate. Mr. Bemis, on the other hand, states that the South Norwalk plant is one of the most successful in the world; and the Chicago plant is furnishing light at a lower cost than a private company would charge for similar service. He considers Detroit the most successful plant after South Norwalk. Allegheny, he claims, has saved enough to pay for the plant out of the difference between the operating expenses and the $96 a year Pittsburg paid for similar arc lights prior to 1906.

Coming to the subject of municipal ownership in Great Britain, the investigations made by the experts sent over have been reviewed by Mr. Milo R. Maltbie, a member of the Public Utilities Commission, of New York City, and by Messrs. Clark and Edgar. Mr. Maltbie declares that, of the plants examined, those operated by municipalities gave in almost every instance a superior service at a lower cost than the private works. He does not consider actual ownership and operation to be necessary for the success of the municipal ownership idea. The power of a city to operate a public service undertaking has been as effective as actual operation in some cases. The same expert reports are held by Messrs. Clark and Edgar to prove that municipal ownership is productive of many and serious ills with little or no compensating good. They see various present difficulties which can only be met by electing municipal officers who will protect the people against injustice.

The gas plants examined by the Investigating Committee were those of Birmingham, Glasgow, Manchester, and Leicester; and by private Companies in London (South Metropolitan Company), at Sheffield, and at Newcastle. On the important subject of the maintenance of plants, &c., Mr. Maltbie says that during last year every municipality set aside out of earnings a larger total to maintain or extend the plant or wipe out indebtedness than did any private company. As to the price of gas to the consumer, Mr. Maltbie points out that the private Company at Sheffield are able to buy good gas and coke making coal at a lower price than any other company or municipality, and find a market for their coke at their very door; that they receive more per ton than any undertaking save one; and that they sold their bye-products for more than the cost of their coal, oil, and other supplies—making a profit thereon of 2·13d. per 1000 cubic feet of gas sold. No other undertaking was so fortunate; and therefore he considers a comparison as regards prices and costs between Sheffield and any other plant not so well situated would be misleading and unfair.

Mr. Edgar and Mr. Clark open their comments on the British gas situation by pointing out that the private companies supply gas at lower prices than do the municipalities. Thus, the relatively small cities of Newcastle and Sheffield get cheaper gas from Companies than do the larger cities of Manchester, Birmingham, or Glasgow. The difference in cost per ton of coal does not explain this difference in the selling price of gas, according to the reviewers, who find that the greater efficiency in management and in energy in selling the bye-products has much to do with the lower prices. The service given the consumer by the private companies is declared to be superior to that given by the cities, though it is pointed out that the investigation of the illuminating power of the light supplied was incomplete in the municipal plants, because of the authorities declining to permit the experts to make full examination. They say on this point: "The whole question of the quality of the product of the municipalities is in doubt. The members of the Commission and the experts who are familiar with gas and photometry see no escape from the conclusion that the above facts show that the service of the municipalities is not what it is claimed to be; that the municipalities are unwilling to have the actual quality of their service determined by independent and competent authorities; and that the gas supplied by private companies is much superior in candle power to that supplied by municipalities."

With regard to the financial aspect of the question, the reviewers make the following remarks: "In the year covered by this investigation, if, in the city of Birmingham, the Newcastle price of gas had prevailed, the consumers would have been £262,600 better off; if the Sheffield price had prevailed, they would have saved £350 900. The amount paid by the Birmingham gas undertaking into the common good was £69,813. So it seems that this city is playing a losing game with its municipal plant. It is mulcting its gas consumers from £250,000 to £350,000 a year in order that it may help out the municipal treasury with a paltry £70,000. In the case of Manchester, if the Newcastle price had prevailed, the gas consumers would have saved £47,500; at Sheffield's price, they would have saved £111,300. The amount contributed to the City Treasury by the gas business was £60,000. In the case of Leicester, at Newcastle's price the consumers would have saved £65,200; while if Sheffield's price had obtained, they would have saved £90,500. The amount contributed by the gas business to the common good was £43,466."

TENDRING HUNDRED WATER SUPPLY.

Bye-Laws for the Prevention of Waste, &c.

At the Town Hall, Harwich, last Wednesday, Mr. P. M. Crossthwaite held an inquiry, on behalf of the Local Government Board, concerning an application made by the Tendring Hundred Water Company for the confirmation of bye-laws they had framed for the purpose of preventing waste, misuse, undue consumption, or contamination of the Company's water. Mr. C. H. Munroe represented the Water Company; Mr. C. E. Jones appeared for the Corporation of Harwich; and Mr. S. J. Naldrett for the Tendring Rural District Council. Among the professional gentlemen who were in attendance were the following Medical Officers of Health: Dr. Thresh (Essex), Dr. Gurney (Harwich), and Dr. Cook (Tendring Hundred); also Professor W. R. Smith, a member of the Royal Institute of Public Health, and Dr. James Nimmo, Consulting Chemist. These gentlemen were to have been called as witnesses; but as the parties came to an agreement, their attendance was unnecessary. Before the inquiry opened, the Counsel who were engaged had a long private consultation, at the conclusion of which they were able to announce that a satisfactory settlement had been decided upon. The chief concession made by the Company was that the bye-laws, so far as they related to water-fittings and fixtures, should only refer to future buildings, and not to those existing, as proposed in the bye-laws. This was practically the chief point; but another question was briefly discussed. It had reference to the length of the service-pipes, which it was provided should in the future be of lead instead of iron, in order to prevent corrosion, and also so as to secure a better and freer service of water. Counsel for the Rural District Council complained of the hardship this would inflict on outlying farms and cottages, as a very large additional expense would be incurred in laying down pipes over a considerable area. To meet this objection, it was agreed that any service-pipe extending beyond the distance of 200 yards from the Company's main might be of iron instead of lead. In accepting the modified proposals of the Company, Counsel, on behalf of the Harwich Corporation and the Tendring Rural District Council, as well as other gentlemen present, testified to the excellent character of the water supply, which, as Dr. Thresh had said, was one of peculiarly organic purity. Before the proceedings terminated, Mr. Naldrett raised a legal point which he asked the Inspector to make a note of. He contended that the Company's bye-laws could not affect the Tendring Rural District until the Local Government Board had made an order on the Company to supply water at constant pressure within the rural district. The mere fact that the Company were ready to supply water, and to supply it at constant pressure, was not sufficient; the actual order of the Board must first of all be made, because this would throw a legal liability on the Company for constant pressure. A settlement was thereupon formally agreed to on the terms already indicated, but without prejudice to the point of law raised by Mr. Naldrett.

Derby Gas Company.—The Directors of this Company have declared an interim dividend at the rate of 5 per cent. per annum, less income-tax, on the ordinary consolidated stock of the Company, for the half year ending June 30. The consumption of gas during the past six months showed a considerable increase; and the Directors, notwithstanding the large advance in the price of coal for the current year, do not contemplate increasing the price of gas.

NEW WATER SUPPLY FOR MEXICO.

Hitherto the water supply for the City of Mexico has been of rather limited quantity and poor quality; but we learn from "Engineering Record" that there is now in an advanced stage of construction a new system which will remove both objections. The new system comprises works for taking the water of several springs, a conduit to convey it to the limits, receiving and distributing reservoirs, pumping plants, and a new system of distributing pipes in the city. The new supply comes from four different groups of large springs at La Noria, Nativitas, Santa Cruz, and San Luis, situated along the south-western shore of Lake Xochimilco—one of the ancient and historically interesting bodies of water in the valley of Mexico, lying on the southerly side of the city. The springs are from 20 to 30 kilometres from the reservoirs, which are located on high ground about 10 kilometres from the centre of the city near to, and westerly from, Chapultepec.

The valley of Mexico, in which the city lies, is a great basin 7000 feet above sea level, and entirely surrounded by high mountains. Of the latter, the Ajusco Mountains lie to the south of Lake Xochimilco, and their formation is so porous and their capacity for absorption so great that they appear to yield the underground flow from which the springs mentioned, as well as many others on the south side of the valley or basin, are supplied. The water, as it comes from the springs, is as clear as crystal; and analyses show it to be of a high degree of purity. The four groups of springs yield a total of 700 gallons per second. The new works are designed to take and deliver 562½ gallons per second, or 48,600,000 gallons per day. The population of the city is some 400,000, from which it appears that the new supply provides about 125 gallons per head.

To collect the water, reinforced concrete wells or caissons of rectangular and octagonal forms, with the necessary partition walls, openings, and valves, are sunk into and around the springs to depths of 20 to 30 feet, and with horizontal dimensions from 10 to 30 feet. The pumps are located in or over these wells. To convey the water from the source of supply to the distributing reservoirs west of Chapultepec, a reinforced concrete conduit, to have a total length of 30 kilometres (18¾ miles) is under construction. It runs across the level valley with a hydraulic grade of 0·0003. Its cross-section is oval; the maximum horizontal and vertical diameters being about 6·6 feet. The invert is flat, while the crown is approximately a parabola.

Along the conduit, and spaced 333 metres apart, open concrete stand-pipes about 20 feet high and 30 inches in diameter are built on the conduit, with a manhole in the top of the latter on either side of the stand-pipe, and a gate in the conduit between the stand-pipe and the manhole on the up-stream side. The conduit will work under a normal head of from 5 to 10 feet. Its shell above the invert is about 5 inches thick, and the entire section is reinforced by expanded metal. Owing to the level country, the conduit has a covering of earth rarely exceeding 3 feet, except in approaching the reservoirs. It is laid but a few feet below, and approximately parallel to, the hydraulic grade.

The conduit terminates near, and about 50 metres below, the receiving and distributing reservoirs. They are four in number, and are at an elevation of 50 metres (164 feet) above the streets of the city. Each one is circular, 100 metres in diameter, and deep enough to hold 11 million gallons; the combined capacity being equal to 30 hours' supply for the entire city. For a depth of about 10 feet, the circular wall of the reservoirs is vertical, and from there to the bottom it slopes 1 on 1. The bottom is covered with a heavy floor of concrete. Each reservoir is covered with a concrete roof of girders and slabs carried on concrete columns set on circles concentric around the central octagonal chamber about 18 feet in diameter, which rises from the bottom to the roof of the reservoirs, and terminates in an ornamental tower about 10 feet in diameter above the roof. This chamber has openings in each face inside the reservoir, and is connected to a gate chamber centrally located outside the reservoirs by a concrete tunnel having a diameter of 1·5 metres (5 feet). The only office of this large central chamber in the centre of each reservoir appears to be to permit the flow of water into and out of the reservoir; there being no gates or other means of control in it. The roofs of the reservoirs are approximately level with the ground, and when finished the reservoirs will be covered with earth and sodded; it being the intention to grade the reservoir site, and convert it into an extension of Chapultepec Park.

Outside of, and conveniently located near, the reservoirs, one large controlling gate chamber, surmounted above ground by an ornamental tower, will be constructed. The tunnels above described will run from each reservoir to this chamber, and deliver the water to it for distribution to the city. From the controlling gate chamber 60-inch cast-iron pipes will lead to the city; and an entirely new network of pipes for the latter will be laid. At each of the four groups of springs and wells, the water must be lifted from 6 to 12 metres (20 to 40 feet) to get it into the conduit and give it the necessary head. At the terminus of the conduit at the reservoirs the lift will be 50 metres (164 feet), in order to get the water into the latter.

Single-stage centrifugal pumps will be used for all this work; there being two 24-inch pumps at each of the four groups of wells, and one plant of three pumps at the reservoirs, and having a capacity equal to the sum of the other four. The lift of 50 metres in single stage appears abnormal for this class of pump; but the data are taken from the official statement of the Water-Works Board of Mexico City. Handsome stone buildings will house the pumps. The work as a whole was designed and is being directed by Sr. Manuel Marroquin y Rivera, the Chief Engineer to the Board.

Rangoon Water Supply.—The water supply of Rangoon is receiving attention, and a scheme is on foot to supply 40 gallons of water per head of the population daily, and to raise 10,000 gallons per minute, at a cost of Rs.27,00,000, which would bring up the total cost of the Rangoon Water-Works to nearly Rs.80,00,000.

TELEPHONES
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—MUNICIPAL—
GAS OFFICES 743

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GENERAL MANAGER

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Messrs Bland & Co,

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Yours faithfully,
J. D. Ashworth
General Manager.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Selkirk Town Council held a special meeting on Monday to consider the proposals of their Special Committee, referred to last week, with reference to the taking over of the Gas Company's undertaking. The proposal was to pay annuities of 12½ per cent. upon the subscribed capital of the Company—£4535—with bonds, not bearing interest, at the rate of £15 for every £5 share, payable in thirty years. Provost Sim, who presided, made a long explanation of the situation. He said he had attended the annual meeting of the Company (the Council held shares in the Company), at which a motion was made that the Company accept £15,000 for their undertaking; and the other proposal was made that they would be willing to accept their present dividend of 10 per cent., along with a payment of £1000 as recompense for the Company giving up any rights they might have. The meeting of shareholders was a very small one; and it was difficult to say what the feeling of the meeting was. The Company had reduced the price of gas by 2½d. per 1000 cubic feet in face of the fact that there had been a considerable rise in the price of coal, and that nearly every other gas company were increasing the price of gas. Afterwards a letter was received from the Company stating that they were prepared to accept £15,000. The Special Committee looked carefully into the matter, and saw that if the burgh accepted this offer, it would be impossible for them to supply the same value to consumers as the Company had been giving for some time. A meeting between the Committee and the Directors was asked for and agreed to; but before it was held, the Special Committee resolved to make the offer now under consideration. The reasons for making this offer were principally that the rate of interest was now very high, and it was a bad time for borrowing money; it was a simple arrangement; the shareholders were at present getting 10 per cent., and by the proposal of the Committee they would get 12½ per cent.; and the highest price ever obtained for the shares was £11, while the bonds offered were for £15. The Company were asking £15,000; and they expected to realize from stocks, &c., as much as would make up the sum received to £19,000. The Company's share capital was only £4535. At £11 per share, the value of the concern was under £10,000. Since the offer to accept £15,000 had been received, he had had an interview with Mr. Herring, who repeated his opinion that new gas-works could be erected for £15,000, and that by them there would be considerable saving. In answer to a question as to what the cost would be if they went to arbitration, Mr. Herring said he was satisfied they would not be called upon to pay a larger sum than he had valued the works at—£10,080. Under the present offer, the Council would take everything—works, stocks, accounts, cash, and investments. Some might ask, Why not go in for new works? New works were no doubt much to be desired; but there would be disadvantages. He was in favour of taking over the Company on reasonable terms, rather than any other policy. If the Company resolved to increase their capital, the Council would be bound to oppose the proposal. If the Council's offer were accepted, they would be able to give consumers as good gas as ever they had from the Company; and at the end of thirty years they would have the gas-works free of any burden. A discussion followed, in the course of which the opinion was freely expressed that the Company had always been considerate and liberal; that they had about £4000 in stocks, money invested, and money in bank; and that the Council proposed to lay aside a sum every year, which, at compound interest, would pay the £15 per share at the end of the thirty years. An amendment proposing delay was moved, in reply to which it was pointed out that the adoption of the proposal of the Special Committee did not bind the Council; the question having to be decided by the ratepayers. On a division, the Council, by ten votes to three, adopted the proposal of the Special Committee.

Under "Legal Intelligence" will be found an account of the proceedings before Sheriff Wilson at Elgin last Tuesday, in the petition by the Town Council of Elgin to have the consents of proprietors and residents in the neighbourhood to the erection of a gasholder dispensed with. The subject is a very delicate one for a Sheriff to decide—a consideration which makes it the more necessary to secure a wide-spread knowledge of what transpires at these inquiries, because in law precedent is all-important. I only remember one other case in which application was made to a Sheriff to decide as to whether or not a holder should be planted in the centre of a town. This was in connection with the erection of a gasholder by the Corporation of Gourock. A report of the proceedings on that occasion was published in the "JOURNAL" for April 9, 1895 (p. 763). The Sheriff—the late Sir John Cheyne—dispensed with the consents, and granted permission for the erection of the holder. The case of Greenock was different from that of Elgin, because there it was proved that, in placing the holder on the site proposed, it would be more effectively concealed than it would be anywhere else; whereas, in Elgin the holder will be in the line of view from the windows of some of the best houses in the town. The only objection spoken to in Elgin was that of amenity. This point was also put forward in the Gourock case; but Sheriff Cheyne set it aside, and decided that it had been proved that a gasholder was a necessity, and that there would be no danger or nuisance from it. When viewed in the light of the experience at Gourock, there should be little fear of the Elgin Commissioners losing their case. There must be a certain amount of sympathy with people who have a gasholder erected in front of their windows, because, admittedly, a gasholder is not a thing of beauty; but, with deference, the evidence at Elgin cannot be held to have surpassed that at Gourock, where it was stated by the late Mr. Robert Mitchell, of Edinburgh, that two large gasholders under his charge were within view of the windows of Holyrood Palace, and that there never had been any complaint from residents in the Palace. An amicable arrangement is spoken of at Elgin, which may mean that an endeavour will be made to make the holder as ornate as possible, or to screen it by planting trees around it. The opposition was not very extensive, nor was it very fierce; and if the prospect of some amelioration were offered, it

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would possibly be accepted. But it is a pity any such offer should be made so late in the day.

The thirty-third annual meeting of the Nairn Gas Company, Limited, was held last Wednesday—Mr. J. Gordon presiding. The Directors reported that the extensions and improvements referred to in the previous year's report having been completed, they instructed Mr. Samuel Milne, of Aberdeen, to value the whole works, property, and plant of the Company; and the amount of his valuation—£12,203—appeared in the balance-sheet this time, causing a sum of £121 to be charged against the year's profits as depreciation. The Directors recommended a dividend of 4 per cent., which would absorb £180, and leave a balance of £101 to be carried forward. The Chairman regarded the report as very satisfactory. There had, he said, been a considerable leakage of gas during the past year; but they hoped this would be greatly reduced by the laying of new mains in the High Street. The working report showed that 1727 tons of coal were carbonized during the year, and that 16,635,600 cubic feet of gas were made; the yield of gas per ton of coal having been 9632 cubic feet. The reports were adopted. It was resolved, in view of the high price of coal, that the price of gas be increased; it being left to the Directors to fix the amount.

In the Forfar Town Council on Wednesday, Mr. M'Dougall, the Convener of the Gas Committee, moved the adoption of the Committee's report, in which it was recommended, among other things, that the price of gas for lighting be increased from 3s. 2d. to 3s. 4d. per 1000 cubic feet, the price for trade purposes to be 3d. less. The Committee estimated an income for the current year of £6972, and their expenditure at £6828. This would leave a surplus of £124. The report was adopted.

The Electricity Committee of the Glasgow Town Council reported to the Council last week that the revenue of the department in the year to May 31 amounted to £224,844, and the working expenditure to £106,235; leaving a surplus of £118,609. A year ago the revenue reported was £195,841, and the expenditure £91,416; leaving a surplus of £104,425. Out of the surplus, the Committee paid interest on loans £49,643; sinking fund, £24,141—together £73,784. Depreciation was allowed for to the amount of £41,754, after which there was a surplus on the year's operations of £3069, which has been transferred to the credit of the reserve fund account, which now amounts to £20,536. There was an increase of income from all sources of £29,003; and the working expenditure increased by £14,819—principally due, apart from the larger output, to the higher price paid for coal, and also to an increase in respect of rates, taxes, and assessments. The capital expenditure during the year amounted to £261,056; and the total capital expenditure, less depreciation written off, stands at £1,587,436. The quantity of electricity sold to private consumers was 24,677,993 units—an increase of 4,756,831 units, equal to 23·88 per cent. The number of consumers at May 31 was 15,497—an increase of 1792 during the year. The motors in use amounted to 3202, with a total of 19,805 H.P., as compared with 2595, with a total of 11,954 H.P. The total amount of money borrowed has been £1,522,236, and repaid £132,763. The sum derived from public lighting was £12,616.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 24.

Sulphate of Ammonia.

The week opened with a quiet market, but towards the close there has been improved demand, and all ready parcels have been absorbed at slightly improved prices. The closing quotations are £11 16s. 3d. per ton f.o.b. Hull, £11 17s. 6d. to £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has also been more inquiry for near months, for which prompt prices would be paid, but £12 per ton is generally required. Spring months are being neglected, buyers not seeing their way to paying makers' prices, which are unchanged.

Nitrate of Soda.

This article remains a quiet but steady market, the quotations keeping 11s. 1½d. per cwt. for 95 per cent., and 11s. 4½d. for refined quality.

LONDON, *Aug.* 24.

Tar Products.

The market for tar products remains quiet, with little alteration in prices. Pitch is fairly steady; but there seems to be rather more disposition on the part of manufacturers to accept a reasonable advance on the nominal prompt prices for September-December delivery. Business on the Continent and in South Wales is quiet, and very low figures are reported to have been accepted. Creosote is firm, and makers do not appear at all inclined to sell very largely, unless they can obtain a price well in advance of present quotations. Benzol, 90 per cent., remains in about the same position, though the prompt parcels which were depressing the market a little while ago have been to a certain extent cleared out for the time being. It is possible still, however, to buy at certain ports on the east coast at 8d. per gallon, while very low prices are said to have been accepted in the Midlands. Benzol, 50-90 per cent., is offering at 8½d. on the east coast without success. Toluol is very quiet, and there does not appear to be any demand for this article. Solvent naphtha is steady, though manufacturers appear inclined to accept reasonable offers for delivery to the end of the year. Heavy naphtha is rather quieter than has been the case for some time past. Carbolic acid is without much alteration, though Continental consumers refuse to offer more than 1s. 8d. on the east coast; but manufacturers report having obtained better figures than this. Creosote salts are still firm, but at unchanged prices. In anthracene, business has again been done at 1½d. per unit delivered to consumers' works. Tar appears to be selling at fairly reasonable figures all round.

The average values during the week were: Tar, 15s. 3d. to 19s. 6d. Pitch, London, 26s. nominal; east coast, 25s. 6d. to 25s. 9d.; west coast, 24s. to 25s. Benzol, 90 per cent., 7¾d. to 8¾d.; 50-90 per cent., 8½d. to 9¼d. Toluol, 10½d. to 11½d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. 0½d. to 1s. 2½d.; heavy naphtha, 1s. 1½d. to 1s. 2½d. Creosote, London, 2⅞d.; North, 2⅝d. to 2¾d. Heavy oils,

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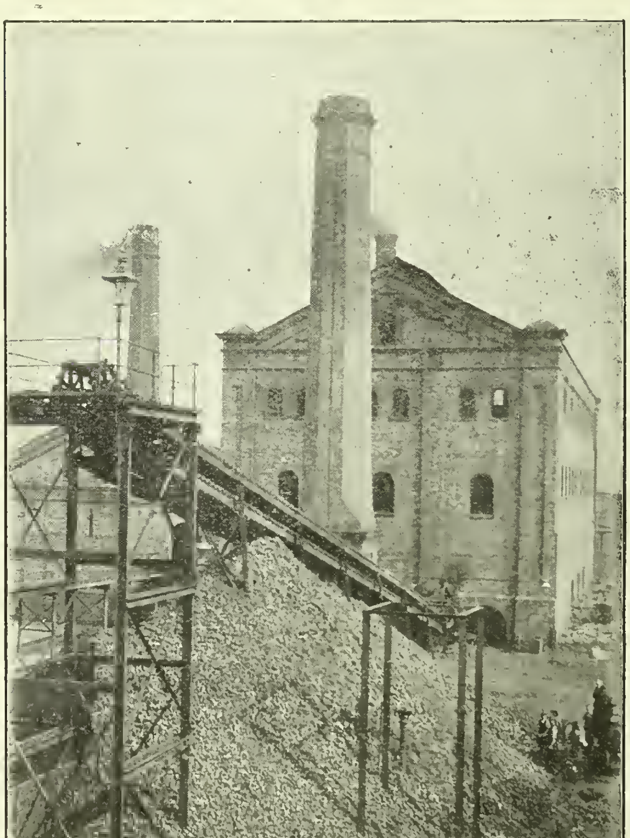

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Sulphate of Ammonia.

The market for this article is steady, and prices do not seem to fluctuate very much. In London, business has been done at £11 17s. 6d., free alongside, for the best makes; and though the principal London Gas Companies maintain their prices of £12 2s. 6d. to £12 5s., ordinary makes upon Beckton terms may be secured at considerably under this figure. In Hull, no business has been done, but the value appears to be about £11 13s. 9d. to £11 15s. there. In Liverpool, business has been done at £11 16s. 3d. to £11 17s. 6d.; while in Leith, £12 has been accepted and refused for prompt delivery. Makers are asking £12 5s. for forward delivery, but cannot obtain more than £12 2s. 6d. at present.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The prices of coal are in the ascendant. As mentioned last week, the operative miners are to have an increase of 5 per cent. in wages; and probably to fully cover the advance coal owners have decided to raise the price of steam coal another 10d. per ton, commencing a week hence. House coal, too, which is being retailed at about £1 a ton—a very stiff price for Lancashire—is expected to be still dearer shortly. Gas coal and cannel naturally share in the consequences of a rising market. The outlook is against users of this class of fuel, the same as it is with others. It is a matter of dearer coal all round; the result of the extraordinary demand. Only a change of circumstances, a decreasing requirement, or a multiplication of collieries can bring about an alteration.

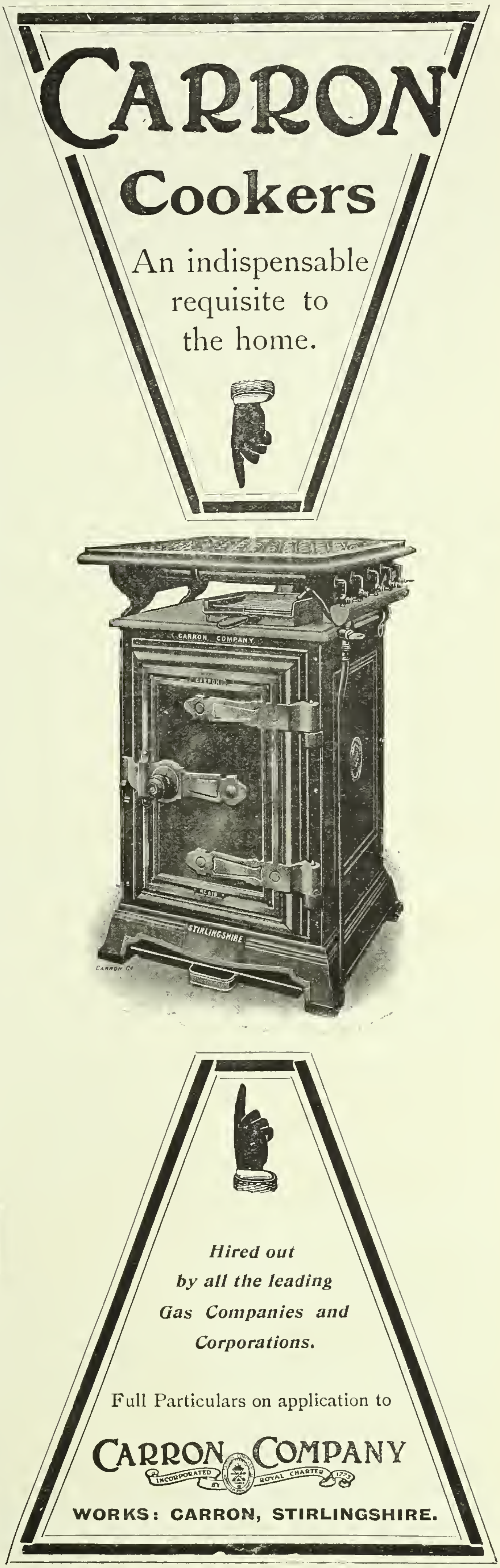
Northern Coal Trade.

There is a steady tone in the coal trade, with a brisk request both for steam and gas coals. In the steam coal trade, there is a better output at the present time; but it is well taken up, the export demand being heavy. Best Northumbrian steam coals are 16s. 6d. to 16s. 9d. per ton f.o.b.; and for second-class steams, the quotation is from about 15s. 6d. to 15s. 9d. Steam smalls are steady, and in rather better supply, at from about 10s. to 10s. 6d. More steam coals are being sold forward; so that over the shipping season a good trade must be expected. In the gas coal trade, the home consumption is now enlarging; and the exports are heavy. Gas coals vary in price, according to the quality, from about 14s. 3d. to 15s. 3d. per ton f.o.b., with some slightly higher figures for special kinds. Some additional contracts for Durham gas coals have been made—one for the Berlin Gas-Works, and another German one; the price over next year being put as about 13s. 3d. to 13s. 4½d. per ton for second qualities, which are thought good figures for far forward delivery. In the coke trade, the demand is full; but gas coke now begins to increase in production. Prices are steady at from 19s. to 19s. 6d. per ton f.o.b. for good gas coke.

Scotch Coal Trade.

There is no slackening of demand; that for ell and splint being particularly strong. Outputs are consequently easily disposed of, and prices remain firm, with no appearance as yet of change. The prices quoted are: Ell 14s. to 16s. 6d. per ton f.o.b. Glasgow, splint 14s. 6d. to 15s., and steam 13s. to 13s 3d. The shipments for the week amounted to 340,182 tons—a decrease of 2550 tons upon the preceding week, but an increase of 32,955 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,086,925 tons—an increase of 540,663 tons upon the corresponding period of 1906. The Scottish Coal Trade Conciliation Board met in Glasgow last Saturday, and agreed to a request by the miners for an advance of 12½ per cent. upon their wages—equal to 6d. per day, and raising the daily pay to 7s. 3d. The masters proposed an advance of 6¼ per cent., but ultimately agreed to grant the 12½ per cent. upon condition that no further request be made for an increase in wages for two months. This is the sixth advance which the miners in Scotland have obtained since the middle of December last, the previous five having been at the rate of 6¼ per cent. each. The total increase in wages during the year has been 1s. 9d. per day.

Burton Gas Workers and their Hours.—A short time ago a memorial was presented by the men employed at the Burton-on-Trent Gas-Works to the Gas and Electricity Committee of the Town Council, in the course of which they respectfully asked for certain alterations in their work and wages. The petitioners, who forwarded their application through the local branch of the Amalgamated Society of Gas Workers, Brickmakers, and General Labourers, claimed that they were only asking to be brought into line with their fellow-workers in other towns. The men asked for a revision of their duties, and for a definition of what should constitute a day's work in the retort-houses, and that the wages of stokers, firemen, day-work men, and purifier men be increased. They pointed out that the wages they were asking for would only place them on a level with most towns in the Midlands; and that if the concessions regarding work were allowed, they would then be doing rather more than the average amount of work in eight hours that is being done in most gas-works. After considering the petition, the Committee decided to receive a deputation of the men, who were accompanied by their General Secretary; and the matter was fully discussed. In due course, the decision of the Committee was communicated to the men. The application respecting the working conditions was granted; but the Committee could not see their way, in view of the bad state of trade in the town, to make any increase in the wages. The men accepted the decision in the hope that at some future time the Committee may be in a position to favourably consider their application



Lincoln Corporation Gas and Water Undertakings.

The abstract of the accounts of the Lincoln Corporation for the year ending the 31st of March last has lately been issued. It shows that there was a gross profit of £12,611 on the gas-works, compared with £12,153 in the preceding twelve months. After making allowance for the sinking fund and interest charges, there was a net profit of £4657, against £4441—an increase of £216. There was a net decrease of expenditure of £469 on the year. With the exception of coke, which shows an increase of £470, low prices ruled for residuals. The decreased expenditure was mainly due to the lower price of coal, and a reduction of £228 in the outlay on the renewal and repair of meters. The net assets now exceed the liabilities by £89,308. With regard to the water-works, the deficiency on the past year's working amounts to £7740, which, added to the balance of the previous year's deficit—£7947—shows a total of £15,687. A sum of £15,800 was included in the district rate estimate for the current year to provide for the then estimated deficit on the present account. The capital expenditure during the year amounted to £16,271, made up of the following items: Boultham boring, £7806; filter-beds, £2131; mains, ballast pits, &c., £5128; new works (proportion of salaries of officers specially engaged), £81; and mains, services, and meters, £1125. The expenditure in respect of the Boultham boring and works in connection therewith up to the 31st of March was £22,411; and the Local Government Board have sanctioned the borrowing of £17,500 only. The total expenditure on the water-works undertaking—including the £22,411 for boring—now amounts to £159,535. Redeemable stock to the value of £40,344 was raised during the year for water-works purposes, and out of this sum a temporary loan of £25,778 by the Union of London and Smith's Bank, Limited, has been repaid.

Gas Supply in North London Suburbs.

At the ordinary half-yearly general meeting of the North Middlesex Gas Company to-morrow, the Directors will report that the sale of gas in the six months ending the 30th of June was greater by 6,804,200 cubic feet, or 8·9 per cent., than it was in the first half of last year; while the revenue from this source and the rental of meters, stoves, and fittings was higher by £1536, and from residual products by £336. The accounts accompanying the report show that the receipts in the half year were £18,201, and that the expenditure was £13,060; leaving a balance of £5141 to go to the profit and loss account. After providing for interest charges, and carrying £100 to the insurance fund and £250 to the renewal fund, the balance at the credit of the profit and loss account is £6392. The Directors therefore recommend the declaration of dividends for the half year at the rates (less income-tax) of 5, 10, and 7 per cent. per annum on the preference, original, and additional capital, and that the sum of £473 should be carried to the reserve fund. This appropriation will amount to £3544, and leave a balance of £2848 to the credit of the profit and loss account to be carried forward. The Directors remark that the necessary contracts for coal have been effected, but at a serious increase in prices; and that there has also been an advance in the cost of oil. The additional expenditure entailed must consequently adversely affect the results of the current half year. The report of the Directors of the Enfield Gas Company for the six months ended June 30 sets forth that the revenue account shows a profit of £5442. Deducting the interest charges, there is a net profit of £4889 for the half year. The Directors recommend the payment of dividends at the rates of 5 per cent. per annum on the preference stock, and 5½ per cent. per annum on the ordinary stock, both less tax; leaving £1121 to add to the undivided profit, which will then amount to £6776.

Additional Capital for the Maryport Gas-Works.

At the meeting of the Maryport Urban District Council on Monday last week, Mr. Maughan moved that application be made to the Local Government Board for sanction to raise £1500 for the purposes of the gas undertaking. Mr. Ross, in seconding the motion, remarked that the gas-works had been profitable, notwithstanding the heavy capital outlay upon them; and the real reason for the Council asking for this money was that the cost of coal this year would be £500 more than last, and therefore they would be losers unless the proposals of the Gas Committee were carried out, as it was thought it was unwise to increase the price of gas at the present time. Hitherto they had always paid for the meters out of current revenue; but this year it would be impossible to do so. With their gas-producing power, however, they would be able to extend their customers and increase their profits. By borrowing the £1500 to provide meters for present requirements and extend the mains, and by producing more gas, they thought that at the end of the year there would be a fairly reasonable profit. If the Council did not pass the resolution, they would close the doors to everybody who wanted gas. Mr. Dickinson said that £400 or £500 of the profit on gas had been spent on prepayment meters; and it would be wise if the Council got to know what profit there had been on them. They had more prepayment than ordinary meters—the numbers being 900 to 700; and as they had been so good as to provide these meters, they should know what profit there was on them. If they had done fairly well as to profit, they only required money for 400 more. He would oppose the motion until he knew what the profit was. Mr. Maughan remarked that the money was not wanted altogether for prepayment meters, but also for ordinary meters and extending the mains. Mr. Richmond supported the motion, on the ground that a person who wanted a pennyworth of gas should be considered as well as one requiring a thousand pounds' worth. On being put, the motion was carried with only two dissentients.

A New Electric Lighting Return.—In the House of Commons last Thursday, a return was ordered, on the motion of the President of the Board of Trade (Mr. Lloyd-George), showing the units of electricity delivered and the average price charged for power and heating and for private and public lighting respectively by Local Authorities and Companies in the Metropolitan Police District during their last completed year of account.

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LONDON, GLASGOW, FALKIRK.

Light Restored at Hurstpierpoint.—It will no longer be necessary for ladies and others at Hurstpierpoint to go about with lanterns and bicycle lamps at night, as recorded last week (p. 531); the Parish Council and the Gas Company having amicably settled their differences. The latter have reduced the price for lighting and extinguisbing the public lamps; and though the work is still to be performed by the Company's man, he is to be regarded as the servant of the Council, who will have entire control of the lighting.

Suicide by Coal Gas.—Richard Collier, a labourer, 30 years of age, living alone at 17, Sheffield Street, Bank, Leeds, had not been seen for several days; and last Friday his brother-in-law broke into the house, and at once detected a strong odour of gas. The body of Collier was discovered in bed completely covered with the bedclothes. One end of a rubber pipe was under them, and tbe other attached to a gas-bracket, the gas being turned on full. A medical examination showed that the man had been dead several days.

Theft of Gas-Brackets.—At the County of London Sessions last Wednesday, before Mr. Hedderwick, Frederick Andrews, 22, a cook, was charged with stealing a number of gas-brackets, the property of the South Metropolitan Gas Company, from a private house at Plumstead on July 15. Mr. Rostron appeared for the prosecution. The prisoner was given a bad character by the police; and it was stated that he bad been previously convicted a large number of times. He was sentenced to 18 months' imprisonment with bard labour.

The Proposed Sale of the Sutton Valence Water-Works.—At the last meeting of tbe Hollingbourne Rural District Council, the Clerk (Mr. H. J. Bracher) said, in connection with the sale of the Sutton Valence Water-Works, that the Mid-Kent Water Order (by the Royal Assent of the Confirmation Bill) had been granted. Therefore the Council now, subject to the consent of the Local Government Board, had power to sell the Sutton Valence water undertaking to the Mid-Kent Water Company. He suggested that the Council, in making application to the Board, should forward the report submitted to them by the Engineer (Mr. Strachan), asking the Board to dispense witb tbe usual inquiry. Mr. Miskin moved that this course be adopted. Mr. Elvy asked the Clerk what the money would be applied to if the water-works were sold. All that the Clerk could say was that the money must be invested for the benefit of the rates. The sale price was £1650; and the price offered was less than this amount. They consulted their Engineer, and he said £1650 was the lowest price they must sell for. After receiving his report and explaining his figures, the Company agreed to purchase for this amount. The outstanding balance at present was roughly about £650; and there was sometbing to come from the Cloth Weavers' Company. They would then have somewhere about £1000 to invest for the reduction of the ordinary rates of Sutton Valence. Whether the Local Government Board would allow this money to be invested for sanitary purposes he could not say. He suggested that the Council should endeavour to get the Board to waive the inquiry to save expense; and this course was agreed to.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.
Engineer (New Zealand). No. 4825. Applications by Sept. 17.
Draughtsman. C. & W. Walker, Donnington.
Works Manager. Belper Gas Company.
Working Manager. No. 4816.
Traveller. No. 4824.
Service and Mainlayer. No. 4815.
Show-Room Attendant. No. 4823.

Gas Literature Wanted.
L. P. Lowe, 1214, Polk Street, San Francisco.

Situations Wanted.
Representative (Gas and Water). No. 4813.
Prepayment Meter Inspector and Collector. No. 4822.

Partnership and Management.
Gas Engineer's Business. No. 4817.

Plant (Second-Hand), &c., for Sale.
Gasholder Tank. Teignmouth Gas-Works.
Gas Engine, &c. "G. S.," c/o West End Advertising Company.

Company Meeting.
The Crays Gas Company. St. Mary Cray. Aug. 28, 6.30 o'clock.

TENDERS FOR

Benzol.
Radcliffe and Pilkington Gas Company. Tenders by Sept. 3.

Coal and Cannel.
Ramsgate Corporation. Tenders by Sept. 2.
Tenby Gas Company.

Coke.
Broadstairs Gas Company. Tenders by Sept. 10.
Ramsgate Corporation. Tenders by Sept. 2.

Tar and Liquor.
Radcliffe and Pilkington Gas Company. Tenders by Sept. 3.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 560.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	"	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6½—7	..	5 0 0
40,000	5	"	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Feb. 28	14	Bournemouth Gas and Water 10 p.c.	27½—28½	..	4 18 3
51,810	10	"	7	Do. B 7 p.c.	16½—17	..	4 2 4
53,200	10	"	6	Do. Pref. 6 p.c.	15—16	..	3 15 0
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	245—250*	..	5 0 0
300,000	"	"	9½	Do. New	185—190*	..	5 0 0
50,000	"	"	5	Do. 5 p.c. Pref.	115—120*	..	4 3 4
206,250	"	June 13	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	"	"	8¼	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	116—119*	..	5 0 10
165,700	"	"	4½	Do. do. 3½ p.c.	87—90*	..	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	26—27	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	106½—108½*	..	4 12 2
1,443,280	Stk.	"	5 2/10	Commercial 4 p.c Stk.	103—108	..	4 16 4
560,000	"	"	5	Do. 3½ p.c. do.	100—105	..	4 15 3
475,000	"	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	"	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	"	"	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk.	123—125	..	4 8 0
55,000	"	Jan.	4	Do. Deb. Stk.	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd.	22½—23½	..	5 2 2
354,060	10	"	12	Do. £7 10s. paid	17½—18½	..	4 17 4
15,182,590	Stk.	Aug 15	4 4/10	Gas-light and Coke 4 p.c. Ord.	92—94*	..	4 13 6
2,600,000	"	"	3½	Do. 3½ p.c. max.	86—88*	..	3 19 7
3,799,735	"	"	4	Do. 4 p.c. Con. Pref.	102—105*	..	3 16 2
4,193,975	"	June 13	3	Do. 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	"	"	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	173—175	..	4 11 5
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93*	..	3 15 3
195,242	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
306,083	"	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Feb. 28	10	Liverpool United A	222—224	..	4 9 3
718,100	"	"	7	Do. B.	164—165	..	4 4 10
152,736	Stk.	Feb. 14	7⅝	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	"	4½	Do. 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	107—108*	..	4 5 7
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	90—91	−2	3 16 11
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	"	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord.	6¾—7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref.	4⅞—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	12¾—13¼	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	12¾—13¼	..	6 0 9
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	246—248	..	4 0 8
209,984	"	"	10	Do. B	246—248	..	4 0 8
523,500	"	"	10	Do. C	246—248	..	4 0 8
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	118—120*	..	4 11 8
1,895,445	"	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159—161	..	4 19 5
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	115—118*	..	4 13 3
60,000	"	"	5	Do. 5 p.c. Pref.	117—120*	..	4 3 4
117,058	"	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Aug. 15	6¾	Tottenham and Edmonton A 5 p.c.	120—123*	..	5 9 9
398,940	"	"	5¼	Do. B 3½ p.c.	98—101*	..	5 4 0
149,470	"	June 27	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
184,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c.	—	..	—
255,636	"	Aug. 15	6½	Do. B 3½ p.c.	128—133*	..	4 17 9
75,000	"	"	5⅗	Do. C 3½ p.c.	—	..	—
80,075	"	June 27	3	Do. 3 p.c. Deb. Stk	77—80	..	3 15 0
845,872	"	Aug. 15	5⅝	West Ham 5 p.c. Ord.	99—102*	..	5 0 6
185,000	"	"	5	Do. 5 p.c. Pref.	118—120*	..	4 3 4
228,300	"	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div."

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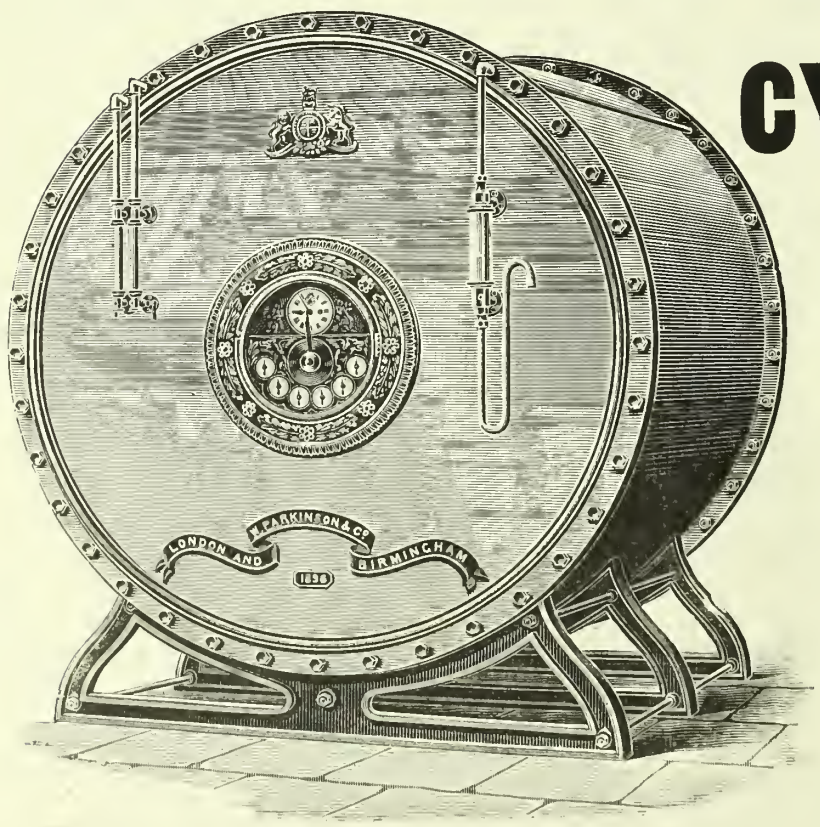

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EDITORIAL NOTES—GAS, &c.

A Large Field for Business.

POINT out the part of the ordinary domestic gas business in which the least amount of custom exists, and there you have the part of the business which requires the exercise of special energy to develop it. That part of the business is not the lighting; it is certainly not the cooking; and the prepayment branch is expanding at rapid pace. The portion of the domestic business that is the least developed is therefore that of heating; and, as suggested in the editorial columns last week, the time now seems to be exceptionally opportune for working up this business to its utmost. For heating, coal holds greatest favour among householders, and not on account of labour-saving, of cleanliness, of handiness, or of economy when the fact is remembered that there is great waste in a coal fire, owing to the necessity of maintenance merely for intermittent use. Coal, too, is dear at the moment. Throughout the country, there are people who are asking for a smokeless fuel. "Coalite," "Carbo," and similar varieties are already on offer, and no substantial gas undertaking will say "Nay" to a good demand for partially carbonized coal—at a price. But all these solid fuels suffer from want of handiness; their use imposes conveyance to and about a house, and frequent attention, though less dirt is yielded by them than by coal. Electricity has tried, by devious devices, to make its way in the heating field; but its success has not been striking—expense and low efficiency being deterrents in progress. It would therefore appear from such considerations as these, that the present is, as we have put it, an opportune time to see whether something out of the ordinary groove cannot be done to give a fillip to the domestic gas-heating business. We do not intend to suggest that there is any lack of commercial enterprise among the major part of the gas undertakings of the country; but what we do suggest is that the time is an especially favourable one to turn more of that enterprise on to the weakest and much neglected part of the gas business, and try to establish it on a more popular foundation.

Sanitarians have long been crying aloud for something to be done to turn to a more refined state the miasmatic atmospheres of our cities and towns; but local authorities nod their approbation, bestir themselves a little over the emanations of the factory chimney, but give scant or no thought to the great mischief wrought by the accumulated emissions of the domestic chimney. They levy rates, for sanitary, protective, and improvement purposes. Large sums are spent, in the name of improvement, in putting up fine buildings, and in the bettering of surfaces and spaces; and the process of deterioration commences at once by the much neglected atmosphere. Here is one of the contrarieties of our municipal life. All constructed things on the earth and under the surface of the earth in the municipal area are expected to come, in some form or other, under the care of the local authorities; but they pay little heed—and that little heed bears largely a perfunctory character—to those things that are not so perceptible as fine buildings, surfaces, and areas, but which occasion incessantly an immense amount of corruption. We know well, and they know, but they do not move in the matter (though the London County Council have threatened to do so failing voluntary improvement on the part of the householder), that their statutory powers are limited in the matter of smoke prevention. But we say, and say emphatically, that municipalities do not accomplish all that they might in this matter. There are no less than 270 statutory municipal gas undertakings in this country; but observation has not created in us any spark of admiration for their special efforts in stimulating the use of the products of the gas-works for heating purposes, with the view of producing one of the greatest sanitary benefits that can be conferred on any community. If these municipal authorities owning gas-works would only lead in this matter, any success that resulted could be used to attract the notice of those municipal authorities in cities and towns served by companies; and between such municipal authorities and companies there is no insurmountable reason why there should not be co-operative work in such improvement. It is not a business in which there can be compulsion, but it is a business in which—given efficient heating-stoves—example and encouraging terms would do much to accelerate the progress of adoption by the householder of heating by gaseous fuel. While we are writing thus, it is a matter of interest to note that the Corporation of Manchester and other surrounding local authorities are taking a keen interest in the forthcoming Manchester Gas Exhibition—a considerable section of which will be devoted to the purpose of demonstrating the advances made in domestic heating by gas.

The gas industry has a large business, and it has kept itself abreast of the demands upon it. But large as this business is, there is every cause why the industry should do more and have more. Many years ago, the learned and presbytic Siemens declared that this country would not be free from smoke until the whole of its fuel was of the gaseous form; and other men of light and leading have asserted that the gas-works ought to be not only the great centre from which the means of lighting is supplied, but the centre from which the means of heating is also distributed by the existing subterranean canalization. We do not think there is full appreciation of the immensity of the field offered by domestic heating. It is calculated that the consumption of coal for domestic purposes—omitting manufacturing use altogether—is equal to $1\frac{1}{4}$ tons a year per head of the population. The estimated population of the United Kingdom in 1906 was 43,660,000; and multiplying this by $1\frac{1}{4}$ tons, we have an aggregate consumption of coal in the United Kingdom for domestic purposes of 54,575,000 tons. This quantity of coal carbonized at the gas-works would produce, calculating an average make of (say) 10,500 cubic feet of gas per ton, 573,037,500,000 cubic feet of gas. The statutory gas undertakings of the United Kingdom, according to the last issued returns, sold 161,407,725,000 cubic feet of gas in the year. Compare these two groups of figures; and the former will be found to be 3·55 times larger than the latter. It is not forgotten that part of the $1\frac{1}{4}$ tons of coal per head still used is employed for cooking purposes in the summer; but the proportion consumed for cooking compared with that used for heating is a diminishing quantity through the popularity of the gas-cooker. But what do these figures mean? The answer is, that the universal deposing of the coal grate and range by the gas fire and the cooker in the United Kingdom would produce an expansion of the present volume of the business of the gas industry by between three and four times, and the removal from our atmosphere of a large amount of its unwholesomeness and banefulness. The gas industry would benefit, the community would benefit both in health and in the savings to be effected by the removal of the injury wrought by the smoke-laden atmosphere, and the consumer would benefit; for has Professor Vivian B. Lewes not said that, for heating, gas at 2s. per 1000 cubic feet is equal in value to the consumer to coal at 18s. per ton? Inasmuch as household coals are being quoted at much higher prices—the best in London at 28s. and 29s. per ton—there is a good margin to work upon, and where the prices of heating gas are in the region of Professor Lewes's 2s., there is economy for the consumer, which is increased by the collateral advantages of its immediate lighting and extinguishing (thus saving the expense of maintenance for only intermittent use), and the almost complete abolition of labour.

It has been remarked, in the earlier part of this article, that the heating business (the possibilities of which are so considerable), if it is to be obtained, must be encouraged; and encouragement undoubtedly means differential prices for lighting and heating. The manufacturers of gas-fires have done

something (though they have not attained the zenith of their hopes) in producing a very essential economy by reducing the consumption and increasing the efficiency of their fires, but what has the gas maker done towards encouraging the business? In most cases, absolutely nothing; and therefore we do think that the subject is worth discussing, particularly at the present time. We know it will be advanced that the time, with high prices ruling for coal, is a wrong one to talk about differential prices for gas. We are not prepared to admit that. It is just the time when, among householders, arguments will go home with more effect than when the prices of solid fuel are low; and we do know this that as the gas business expands so the capital and other charges (when the management has been on judicious lines) do diminish. The use of gas for heating purposes will tend to largely fill the valleys in the output curves, so helping to equalize output without in any really appreciable measure causing addition to the capital expenditure, establishment charges, management, and so forth. The bigger the business of this class, the more attenuated become the outgoings per 1000 cubic feet, and the lower the rate at which profitable business can be done. Of course, the heating business comes when the lighting business is heavy; but the lighting business does not proceed in any great measure during the hours of daylight. That there is business to be done in heating in addition to that already secured, is obvious from what electricians are doing. By push they can get heating business, with inefficient radiators, at 1d., 1½d., and even 2d. per unit of electricity. For instance, in the small area known as the City of London, one of the two Electric Lighting Companies supplying there had as many as 2000 four-lamp radiators linked up to their cables at the end of last winter; and these increased the rate of output on cold days by as much as 500 kilowatts—the charge being 1½d. per unit; and that is dear when the poor efficiency of the radiator is considered. The electrician, however, has found out that the collateral advantages are not of strength sufficient to obtain heating business. The consumer wants something else, and something that will appeal to his pocket. Hence differential prices. The differential price does not present the same difficulty in its application to gas supply that it did a few years since, of necessitating an expensive duplication of meters and piping. A small meter that will register approximately the proportion of gas consumed by each gas-fire is all that is required; and every gas manager knows of such on the market.

Here is the field. If gaseous fuel is to occupy it, it must be competed for in that liberal, commercial spirit that has swept before it the trade of the world. The straight, hidebound policy of monopoly will not do. Against gas there is competition in every field; and sound competitive tactics must obtain. If any of our readers have aught to say on this subject, we shall be glad to hear from them.

The Companies' Bill.

One of the last acts of the House of Commons before the prorogation was the final passing of the Companies' Bill. In numerous small details, the measure as Royal Assented differs from the original; but in its leading features, it remains the same. It is only a deserved compliment to say, although a measure of the kind cannot meet with the approval of all, that to the President of the Board of Trade is due the utmost praise for piloting through such a measure, affecting, as it does, so many sensitive interests. Mr. Lloyd-George took counsel with many men of repute in company law and finance; and the outcome is an Act which, speaking generally, gives much satisfaction. The hypercritical complain that the Act is but another instance of how company legislation in this country always appears to proceed on the lines that only the seamy side is known to the Government, with the result that wholesome enterprise is much and unjustly confined. This is plausible argument; but it will not bear analysis. To a degree it is, of course, true. But so long as malfeasance exists, the need is proved for correction and control; and, if rectifying legislation can be produced, it protects straightforward conduct from the stigma or malign influence of wrong-doing, and the tendency is to sustain confidence. In this way, honest and circumspect joint-stock enterprise gains. There is no direction in which protecting and regulating legislation is so necessary as in connection with the promotion and financial administration of companies to the custody of which the public commits large sums of money.

The measure was founded on the recommendations of the Departmental Committee appointed in 1905 by the Board of Trade; and the principle underlying it (as stated in the King's Speech at the close of the session) is the affording of fuller information to all who may seek for it concerning the Companies registered under the Companies' Acts, and to give a greater degree of protection to creditors, shareholders, and the public generally. In the first place, people are too prone to judge the character of a concern by the character of members of the directorate. A greater mistake could not be made. Men whose probity is above reproach sometimes fall victims to machinations of rascals who live and enrich themselves on the gullibility of others; and who are awake to the fact that the adorning of prospectuses with reputable names serves the object of entrapping public money. The Act aims at fraudulent prospectuses and the protection of innocent investors. The requirements of the Act of 1900 are enlarged; and any prospectus henceforth issued must disclose with fulness any material facts which would be calculated to influence the minds of intending investors. It will go hard with promotors against whom the charge can be sustained that they have neglected in their prospectuses to divulge material facts which might have influenced investors. To our regret, there have been a fair number of instances of obliquity in this regard in company promoting in the gas industry during the past two or three years; and the more strengthening of legislation there is, the better, if only it is effectual in killing these rank growths. To avoid disclosure, there have been promoters who have sold shares direct on the Stock Exchange, without issuing a prospectus. But such as these must now lodge a full statement of facts with the Registrar at Somerset House, where inspection can be made. The provisions of the Companies' Act of 1900 are also enlarged by making it necessary to register all mortgages and charges with the Registrar of Joint-Stock Companies, including those relating to landed property and book debts. Other clauses will remove doubts as to the validity of perpetual debentures and debenture stock, and enable a company to keep alive and reissue debentures which have been redeemed. Another section requires every company to file annually with the Registrar a statement of their affairs in the form of a balance-sheet. It is to contain a summary of its capital liabilities and assets; but it need not embrace a statement of profit and loss. Although this provision is new to English law, similar provision has since 1888 been part of the Indian law relating to companies, and since 1896 has formed part of the law of the Colony of Victoria. There is therefore precedent as to its beneficial working.

A useful provision is one passed in accordance with the recommendations of the Royal Commission, allowing, under conditions specified in the Act, companies to pay interest out of capital on shares issued for the purpose of raising money to defray the expenses of the construction of any works, buildings, or plant, which cannot be made profitable for a lengthened period. In Committee, an abortive attempt was made to restrict this provision to works of a "permanent" character, on the ground that some companies might make an improper use of the power; but we think ample safeguards are provided by, among others, the restrictions that no such payment is to be made unless authorized by the Articles of Association, or by special resolution of the Company, and, in any event, the Board of Trade are to have a voice in the matter and powers of inquiry and regulation. As Mr. Lloyd-George says, if investors are to be induced to put their money into works in this country, the area of investment must be made as wide and inviting as possible; and this provision will therefore be very valuable. In the measure as it originally stood, there was power to companies to issue shares at a discount, but that has been deleted. Though the disability operates hardly in cases where shares and stocks stand in the market at a little below par, on the whole it is better the limitation should not be relaxed. The scope of City tricksters does not want extending; and we can well see how such a power might work to the injury of company and investors, on the escape of knowledge of a prospective issue, by the depressing of the particular stock or shares below par. The difficulties in the paths of gambling and mischievous conduct, which ruin on the one hand and enrich the prime movers on the other, do not need removal; and therefore, at the instance of the President of the Board of Trade, the clause was expunged, and an endeavour to replace it was frustrated.

When in Committee, there was great discussion around a clause proposing to give power to a Court of Law to grant

relief to Directors in cases where a breach of duty had been caused by honest oversight, inadvertence, or error of judgment. The debate indicated how much there is to be said on both sides of the question. Directors after all are only human; and they are as prone to err as other people. Honest oversight, inadvertence, and errors of judgment are venial offences; and in such cases the utmost consideration and sympathy can be shown in our Law Courts. Mr. Justice Buckley has stated that in no case has a director been held responsible for an innocent mistake; and Lord Halsbury has placed among his dicta that a director could not be held liable unless he could be charged with some sort of moral obliquity. From this it is plain the specific provision for relief was really unnecessary; and it is to be hoped that the express power to the Courts will not loosen the strings about the incompetents and the wilfully negligent, nor afford a loophole for the escape of any from the penalty of their treachery to the confidence reposed in them.

Among other sections, it is noticed that the wrongful use of the word "Limited" in the titles of public companies will in future be visited with a heavy penalty. The Act also tightens the hold over Companies established in this country and carrying on businesses in other countries. We cannot understand why the Board of Trade caused the removal from the measure of what was originally intended to be included in connection with the auditing of Companies' accounts. It was at first proposed that, in the case of every company whose authorized capital amounts to £50,000, one at least of the auditors should always be a person who professionally carries on the business of an accountant; and we do think that the excision of this provision is not in the best interests of public safety. All too often in the case of public companies men are appointed auditors who are no more fitted for the duty than the veriest tyro in business. A point which will give great satisfaction is the kindly attitude of the President of the Board of Trade to profit-sharing or copartnership. Mr. Theodore Taylor, well known in trade co-operative work, was the author of a provision for exemption, from a clause bearing on the number or the increase of the number of the members of a company, of any company which confines the transfer of its shares to persons in the service of the company. The provision was accepted in Committee by Mr. Lloyd-George with the remark that "it is very desirable this "kind of arrangement should be encouraged." "It has," he added, "worked very well in promoting good feeling be-"tween employer and workman; and it is a thing we ought "to do all in our power to help along." With this expression of opinion, there will be a widespread tacit consent, but will it incite to further action? However that may be, of the provisions of the new Act the Directors of every Company should have cognizance; but the details are too voluminous for treatment in our columns. All we can hope is that this addition to company legislation will have its intended effects, and ensure to the public greater safety and protection from the snares that beset in connection with joint-stock undertakings.

Prorogation of Parliament.

Our jaded legislators left Westminster greatly relieved last Wednesday. The work of the session has been exceedingly heavy; for the Government have, with unpitying zeal, kept the elect of the people close at their labours on an assortment of public measures which, in the aggregate, looked terribly formidable. Quantity has, in fact, taken precedence of quality; and in more than one part of the House murmurings have been heard of hardship and precipitate legislation. These are times when every question petitioning for legislation should be rigorously examined; but it cannot be asserted that the whole of the legislation of the past session has received the consideration that it should have had. When the names of the measures passed come under review, it is striking how few of those of first importance mentioned in the King's Speech at the opening of Parliament have become law—the long list before us being made up for the greater part of Acts of second-rate importance. The amendment of the patent laws was one of the subjects noted in the King's Speech at the opening of the session; and it has been honoured by reference in the King's Speech at the close of the session. The Act has been received with mixed views as to its prospective blessings and otherwise. But manufacturers and commercial men on both sides of the House of Commons welcomed the measure with open arms; and the House of Lords had not much fault to find with it. Lawyers were doubtful, and prognosticated a great increase in litigation. But generally in the manufacturing and commercial world it is believed that, as said in the King's Speech, the Act will restrain the abuse of monopolies, and strengthen the provisions in regard to the revocation of those British patents which are worked abroad, but which are not being adequately worked in this country. The Companies' Act and the Employers' Liability (Insurance Companies) Act have also been passed. The Companies' Consolidation Bill was dropped; and with regard to the much-agitated subject of the hours of labour in mines, though three measures were introduced they were afterwards withdrawn. The Government, however, has already another Bill drafted for their programme next session, which Bill has for its intent the statutory limitation, by stages, to eight hours of the miner's day from bank to bank. The Valuation of Property (England and Wales) Bill was promised, but was not introduced. The Government have enough remainders and unaccomplished work to last them through another session, without taking upon themselves anything fresh. Outstanding among other questions of general importance were the novel fiscal proposals of the Chancellor of the Exchequer in submitting his budget. Everyone knows now that earned incomes are to receive (as they deserve to receive) a reduction of 25 per cent. of the income-tax. But unearned incomes, including the incomes of those who have provided for old age by thrift, are to continue to bear a tax of 1s. in the pound. This remark calls to mind that the Chancellor of the Exchequer hopes to have in hand next year £1,500,000 which he expects to be able to set aside for old-age pensions. How much of this sum will be provided by those who have made their own provision for old age? The gas legislation of the session was dwelt upon last week; and there is now nothing further to add.

Overlapping Gas-Supply Districts in the Midlands.

From an article in another part of the "Journal" it will be seen that a curious position of affairs has arisen in connection with the gas supply of Draycott and the adjacent village of Breaston. These places are within the area of the Long Eaton Gas Company, but as no steps were taken to afford a supply of gas, a Company was formed at Draycott about twenty years ago to undertake this work, which they were allowed to carry out. It appears that they have given general satisfaction to the consumers; their prices ranging from 2s. 6d. per 1000 cubic feet to 1s. 6d. for gas used for engines. The Company's position has, however, lately been assailed by the Long Eaton Company laying a 12-inch main through Breaston to Draycott, and offering a supply of gas at 2s., accompanied by the inducement of free fittings. This action, though it has led the Draycott Company to lower their maximum charge to 2s., does not seem to have been well regarded by the consumers, for we learn that there exists "a general feeling of resentment against the new-comers." It is thought that there is an ulterior motive behind the concession made by the Long Eaton Company, whose price in the town is 3s., less 10 per cent. Nor are the Company's consumers altogether satisfied, as they think that if gas can be conveyed several miles and then sold profitably at 2s., they at the fountain head must be greatly overcharged. It appears that meetings of the shareholders are to be held to consider this and other matters; so that more will be heard of it. Meanwhile, it may be suggested that, as there is right on both sides, a spirit of conciliation should be shown, which might lead to some satisfactory arrangement. After having been twenty years in uninterrupted possession of a district which they were the first to supply with gas, it seems, on the face of it, rather hard that the Draycott Company should be subjected to the competition which has been sprung upon them. But we shall hear what the other parties have to say.

Municipal Trading Drawbacks.

People who believe in municipal trading are usually of an optimistic temperament, and, though confronted with disagreeable facts opposed to all their fine theories, they are firmly convinced that all will come right some day. Success and failure in municipal enterprise mean practically the same thing to its friends. A business may not pay, rates may advance, debts be piled up, and current accounts be overdrawn. The public may

even have to put up with an indifferent, cramped, or costly service at the hands of the municipality, compared with that which a company would have afforded. Still the municipal trader sees bright visions ahead, and is quite content to pay—and let other people pay—high rates because of the advantage which he is convinced will accrue to somebody in a future more or less remote. No doubt this optimism partly arises from a natural reluctance to face unpleasant truths. It is of no use going to meet trouble ; and so long as ratepayers do not rise in open revolt, their representatives on the municipal bodies may find excuse for not scrutinizing too closely the financial and other results of some of those grand schemes on which they have embarked. From time to time facts have to be faced, however unpleasant the duty may be ; and the optimist then has need of all his philosophy. The promoters of the electric lighting undertaking at Barnstaple have been sorely tried of late. This is one of those grand schemes which, when started, was going to effect a revolution in the old Devonshire town. There was to be lighting for next to nothing, and no one knew how much profit to go towards the reduction of the rates. What has really happened is a not uncommon experience. The municipal electric light has been used to light the streets at a cost two or three times greater than that at which they could have been more efficiently lighted with gas. Though the rates have thus been indirectly drawn upon to bolster up the undertaking, the revenue account still shows a deficit, and the bank overdraft has grown to something like £3500. Attention was called to this unsatisfactory state of the finances at a meeting of the Town Council yesterday week. It was pointed out that the payment of bank charges on an overdraft which ought never to have been incurred is illegal, and that it is in the power of any burgess to obtain a *mandamus* to compel the Council to raise, by means of a rate, sufficient money to clear off this debt. It does not appear to be likely that anyone will take this action, which would be attended with very unpleasant consequences for many people who are not responsible for the Council's wrong-doing. Some such strong measure as this may, however, be needed to remind certain municipalities that the law exists, and can be made operative. In the case of Barnstaple, it was decided that the Borough Treasurer should produce at each monthly meeting a statement showing how the accounts stand after payment of all bills that are due. This will at least show whether or not the Council are getting deeper into debt; and it may act as a check upon reckless or unnecessary spending.

PERSONAL.

Mr. Evan Rees, of the Neath Corporation Gas-Works, has been appointed Manager of the Blaina Gas-Works.

Mr. Ernest Moon, K.C., one of the leaders of the Parliamentary Bar, has been appointed by Mr. Lowther as Speaker's Counsel, in succession to the Hon. Sir E. Chandos Leigh, K.C.B., K.C., who has retired, after filling the position since 1883. Sir Chandos Leigh is closely connected with the gas industry; being a Director of the Imperial Continental Gas Association.

OBITUARY.

The death occurred recently, at the advanced age of 87, of Mr. T. R. Richardson, who was for some years the Secretary of the Woolwich Consumers' Gas Company. In 1861 he was in the Company's service as a collector; but a few years later he obtained the higher appointment, in succession to the late Mr. I. A. Crookenden, who became Secretary of the Phœnix Gas Company. On the amalgamation of the Woolwich Companies with the South Metropolitan Gas Company in 1885, Mr. Richardson retired upon a superannuation.

We regret to learn of the recent death, at the age of 55, under painful circumstances, of Mr. John Whitehead Carr, the Manager of the Municipal Gas-Works at Johannesburg. He was on a visit to his daughter, and appeared to be in his usual health. While engaged in conversation, he was suddenly taken ill; and he expired, as the result of heart failure, before medical assistance could be obtained. Deceased was a brother of the late Mr. William Carr, of Stalybridge, and of Mr. Isaac Carr, the Gas Engineer of the Widnes Corporation. It may be remembered that the works at Johannesburg were designed by Mr. Thomas Newbigging, and their erection was superintended by Mr. William Carr, who returned to England in 1892. He was succeeded by his brother John, who managed the works continuously (with the exception of a short period during the war in the Transvaal, when he returned for a time to England) till his death. He was elected a member of the Gas Institute in 1893, and in due course passed into the Institution.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 645.)

Movements last week on the Stock Exchange in the prices of leading issues were irregular and uncertain; and—unlike the preceding week which closed better than it opened—the moderate advance of the earlier days was lost in the later ones. It was account week; and fresh business was not abundant. Happily the settlement was not a formidable affair. A favourable anticipation of this operation imparted some cheerfulness to the opening, especially choice investment lines. Consols improved $\frac{5}{16}$, and Home Rails were pretty strong; but the American market was a weak spot. Tuesday improved further on this position; and under the influence of both speculative and investment buying, there was a fair advance in prices—Consols scoring another $\frac{1}{4}$. On Wednesday, the tide was still flowing favourably, and Consols and Home Rails were carried up still higher. But on Thursday the tide ceased; and there were symptoms of a general arrest. The rise had brought in realizations to secure profits, and prices shrank accordingly—Consols being a loser of $\frac{3}{16}$. The adverse influence continued on Friday, prompted to a large extent by foreign dealings and monetary movements; and Consols fell another $\frac{1}{8}$. Saturday was no worse—indeed, some leading foreign departments were better; and Consols were steady. In the Money Market, there was a very abundant supply for loans; and all requirements for the month's end and for the Stock Exchange were easily met. Discount rates were on a falling scale, but became firmer before the close. Business in the Gas Market was of decidedly slender proportions—quite the quietest week we have so far had. But the condition of stocks was unimpaired by the absence of support, and a good many of the quotations moved upward nicely. In Gaslight and Coke issues, the ordinary was lightly touched every day; and after an opening bargain at $92\frac{3}{4}$, the price was pushed up to 94, at which it was very steady—a rise of 1. The secured issues were fairly active for them. The preference changed hands at from $103\frac{3}{4}$ to 105; and the debenture at from $81\frac{1}{2}$ to $82\frac{1}{2}$—a fall of 1 in quotation. In South Metropolitan, after a small parcel had been done free at $118\frac{1}{4}$, there were dealings at from 119 to 120—a rise of $\frac{1}{2}$. In Commercials, the 4 per cent. marked $106\frac{1}{2}$ *cum div.* and $102\frac{1}{2}$ *ex div.*; the $3\frac{1}{2}$ per cent. $100\frac{1}{2}$ *ex div.* The Suburban and Provincial group were strong and quiet. Alliance old was done at $20\frac{1}{2}$ and $20\frac{1}{16}$; Brentford old at 250; British at 42; South Suburban at $117\frac{1}{2}$; ditto debenture at 124; West Ham at 102 and $102\frac{1}{4}$; ditto preference at $118\frac{5}{8}$ and 120. The Continental Companies were extremely inactive. Imperial advanced a point, with business done at $174\frac{1}{2}$ and 175; European fully-paid marked $22\frac{5}{8}$; and Union was not dealt in. Among the undertakings of the remoter world, Buenos Ayres changed hands at $11\frac{3}{32}$, ditto debenture at $94\frac{1}{4}$; Primitiva at $6\frac{15}{16}$, ditto preference at $5\frac{3}{32}$; River Plate at $13\frac{1}{4}$; ditto debenture at $93\frac{1}{2}$ and $94\frac{3}{4}$; San Paulo at $13\frac{1}{4}$; and Oriental at 144.

ELECTRIC LIGHTING MEMORANDA.

Municipal Electricity Trading—Some of the Reasons for Poor Results—Deficits and Narrow Net Profits in the Metropolis and Provinces—Revenue from Street Lighting—Losses and Inadequate Depreciation in 1906.

About this time of the year, we have the opportunity, through the particulars published in the electrical press, of calling attention to the seamy side, financially, of municipal electricity supply. It is necessary to be candid on the subject, as our electrical contemporaries may rise up in wrathful indignation (as one did some time ago), and charge us with not being impartial by neglecting to call attention to those undertakings that have done well, as shown by accountancy fair or suspicious. Whether fair or otherwise, it is not always possible to say without having the complete accounts before us. Let us make the position clear. As exhibited by the published figures, many electricity undertakings have been successful; but from all parts of the country, we have a goodly collection of undertakings that have fallen far short of the prophecies, and of the handsome contributions that they were going to make to the relief of the rates. There are some that have made contributions; but we do not know of many instances where this has been anything better than a sham when the increased expense of public lighting is brought up as a contra account. In pointing to representative undertakings in all grades of the business that have not in the last municipal account year done anything conspicuously good from the financial point of view, we are taking them from all parts of the country; and it will therefore be no use charging us with unfairness in selection on the ground that the poor financial result is due to local circumstances. If these were altogether to blame, then we should say that the success of the other undertakings is also due to local conditions (included in which in some cases is superior administration); and that the local conditions of these concerns cannot possibly avail those undertakings that show a poor result, and are struggling with adverse local conditions that had existence when the ruling authority were tempted and advised to launch out into speculation. There are towns the conditions of which have been proved by a big

sacrifice of money to be totally unsuitable for profitable electricity supply. Complaint is made in several places that the increase in private consumption is not going on at the rate expected, that capital charges and interest are advancing out of proportion to the increasing business, that the shortening of the period for loans (which is found necessary in the cause of sound finance) presses somewhat heavily, that the pressure of gas competition necessitates lower charges for electricity, and that the dearer coal markets are making the outlook very dull. For example, as mentioned last week, Derby reports an increase in the coal bill of £1000; Newport (Mon.), of £1192; and West Ham, of £2580. Assessments for rating are also ascending, where local authorities do not favour their own trading undertakings. In the face of these uncomfortable circumstances, the price of electricity has to be reduced to compete with gas. Cardiff and Ipswich (among other places) can tell one something about this, and the effects. The higher efficiency electric lamps are also coming into the swim to add to the immediate difficulties of electricity suppliers. But we are interested to see that the ardour of many local authorities for getting money out of the undertakings in aid of the rates is diminishing. Hope cannot be sustained by recurring deficits or lean profits. Of all reasons why the results are so bad in many towns, the greatest is that there is not the scope for the business, with excellent value offering by the gas undertakings.

Having made it quite clear, to please our electrical friends, that the municipal undertakings whose results are here noticed are not (although the figures themselves make the point obvious) representative of those that have been successful, we will first turn to certain of the London concerns. The figures should be prefaced with the remarks that the information available does not afford knowledge, in many cases, as to how reserves and depreciation have been dealt with, whether fair payments have been made for establishment expenses, whether the undertakings are properly assessed, whether other departments have lent a helping hand, and whether public lighting has been drawn in as a big contributor of support. However, Bermondsey declares a balance of net profit of only £590. Ealing takes credit for a net profit of £1768, which is £550 less than the preceding year. Finchley has a deficit of £170; but one of our electrical contemporaries trots out the stale claim that this must not be regarded as loss, seeing that the local Gas Company have reduced their price from 4s. 5d. to 3s. 8d. per 1000 cubic feet of gas. Electricians seem to cherish the notion that reductions of gas prices only set in with their advent as competitors. Reductions in the price of gas commenced a century ago; and we do not think any electrician who does not wish to be written down as a dolt will say the gas industry has been standing still since electricity opened up its competition. It is forgotten—or perhaps it is not known—by some electricians that most gas companies are now working under the sliding-scale of price and dividend, whereby dividends are increased by reductions of charge, decreased by increases, and stand still if there is no change in price. There is inducement here apart from competition. But to proceed. Hammersmith realized a net profit of £14, compared with £2631 in 1905-6 and £5283 in 1904-5. The gross profits of Hornsey only advanced by £854; the deficiency being £1153. There was a balance overdrawn in the previous year of £267; so that the ratepayers have to provide, for the privilege of allowing certain folk in the district to use electricity, a sum of £1421. We notice several undertakings like Poplar that find it difficult to put a different complexion on their finance, though reporting increased outputs of electricity. Poplar takes credit for a net balance of £574; in the previous year for £600. In St. Pancras, the Council report a decrease in the number of units of electricity sold—from 1,628,803 to 1,597,750—owing to a decline in the demand for power; only 293,248 units having been sold under this head, against 418,251 units in the previous year. At West Ham, the deficiency was £1830. We have not seen any statements from the whole of the Metropolitan Borough undertakings; but these are the least satisfactory of those that have been published, and, as will have been remarked, they form a good proportion of the whole.

Let us now look round the Provinces. Many of the big undertakings distributing in choice parts have not done so well, from the net profit point of view, as in some previous years; but mention is here made of only those concerns that have kept a little above or a little or much below the line dividing net profit from deficit. Accrington shows on the financial year a net profit of 7s. 3d.; Batley, of £494; Beckenham, of £463, as compared with £799; Blackburn, of £1528; Brighton, a deficit of £10,233, and a reduced consumption; Broughty Ferry, a net profit of £127; Buxton, a deficit of £3; Cardiff, a deficit of £4638 (in the previous year a net profit was shown); Carlisle, a net profit of £9; Cleckheaton, a deficit of £193; Colchester, a net profit of £1224 (a reduction of over £500); Darwen, a net profit of £66 (another source of information states £96); Dover had to take £653 from the previous account and £470 from reserve to make both ends meet; and Dudley reaped a net profit of £68, against £323. At Eastbourne, the gross profit was £1210 more than in the previous year; but the net profit was only £1568, or an increase of £266. Elland shows a deficit of £476; Farnworth, a net profit of £300; Gloucester, a loss of £842; Govan, a net profit of £547; Gravesend, a net profit of £245; Hove, a deficit of £592; Hull, a net profit of £1813; and Ilford, a net profit of £885, as compared with £1870. Ipswich did very badly; the deficit being £1363, compared with £249. Here, however, a reduction in price was made; and the Engineer reports that it brought a number of new consumers, but the new business during the year was a long way short of what was expected. The number of consumers increased from 284 to 372; yet with this increase the deficit was much larger. Kendal exhibits a deficit of £715; Kettering, an adverse balance of £1016; King's Lynn, a net profit of £593; Kirkcaldy, a deficit of £39; Lancaster, a net profit of £369; Longton, a deficit of £202; and Morecambe, a deficit of £1734. Newport (Mon.) is interesting. A deficit there of £2286 succeeds a deficit of only £372 in the preceding year. Yet some time ago there was an electricity exhibition held in the borough, about which some good things were said, and around which great expectations were formed. Cruel fate leaves in the accounts an outstanding balance on the exhibition of £206. It is safe to say there will not be another electricity exhibition in Newport just immediately. Leigh shows a deficit of £409, compared with a net profit of £219 in 1905-6; Loughborough, a deficit of £1112; and Oldham, a net profit of £1459, but, after deducting the deficit for the preceding year, the carry-forward is only £91. The accounts of Sheffield present a net profit of £2555 (compared with a deficit of £1374); but Sleaford (Lincs.), by including the balance from last year, do not appear (so far as the published accounts can be interpreted) to have met their liabilities. The electricity department of the Stalybridge, Hyde, Mossley, and Dukinfield Board incurred a deficit of £5466; Sunderland one of £690, against a net profit in the previous year of £1429; and Sutton Coldfield, one of £99. Swansea claims a net profit of £741; Taunton, of £335; and Warrington £2516, against £2762. Whitby shows a net deficit of £1935. At Wigan the electricity department and the tramways are run together; and there is great dissatisfaction with the financial position. On the electricity department, a net profit of £2489 is declared; on the tramways, a total deficit of £18,563. Wishaw shows a deficit of £593; and Yarmouth, a net profit of £1118.

Many an electrical undertaking would be in the depths of Queer Street if it were not for the public lighting, for which they charge the ratepayers enormously for the illumination of a very small mileage of streets. It is noticed that the income from street lighting in Cardiff is no less than £8394; still, as mentioned above, the deficit is £4638 on last year's trading of the undertaking. The Crewe concern had an income from the sale of electricity by meter of £3078, and from public lighting of £3358; the surplus on the year being only £680. The sale of current for lighting, power, and traction at Erith produced £8156, and for street lighting £2199; the deficit on the year's working being £68. At Hastings £15,134 was derived from the sale of current for private lighting and power, and £3960 from public lighting; the net profit on the year being merely £198, or an increase of £81. At Wimbledon, the receipts from the sale of current amounted to £18,230; and the revenue from public lighting was £5730. Through the public lighting here, the ratepayers are badly hit; seeing that this is the price paid for the supply to 62 arc lamps and 1081 electric incandescent lamps.

The Industrial Freedom League have lately issued a leaflet on the results of the trading in electricity supply for the twelve months ending March, 1906. Complaint has been made that this was circulated after certain municipal accounts were published, disclosing improved results; but the League are dealing with a complete year's working, and the complete statistics are not yet available for 1906-7. In good time, the League will have them, and then doubtless there will be issued another circular; the prospects being, so far as we can judge at present, that the results in the aggregate will not look much better than those for 1905-6. The circular points out that the accounts disclose a considerable number of deficits; and in many instances very small balances of receipts over expenditure. In the majority of undertakings, there was no provision at all made for depreciation; and where depreciation was provided for, the amount set aside for the purpose was generally inadequate. On March 31, 1906, of 217 electric light undertakings which had been worked for twelve months or more by local authorities, 143 claim to have made a profit, and 74 admit a loss. The total expenditure charged to capital amounted to £32,929,734—excluding the St. Marylebone undertaking (£1,824,884), which the Borough Council did not commence to work till August, 1905. The net "profit" claimed, after the necessary provision had, in most cases, been made for interest and sinking fund, but before providing for depreciation, was only £478,675, or about $1\frac{5}{8}$ per cent. Of this profit, nearly one-half (£230,108) was made by nine of the 143 local authorities on a capital expenditure of £8,366,975. The balance of £248,567 therefore represents rather less than 1 per cent. profit on the remainder of the capital expenditure, amounting to £24,562,759. The losses made in respect of 74 undertakings, or 34 per cent. of the total number, amounted to £82,161. Nearly three-fourths of the undertakings worked at a loss had been in operation for periods varying from three to fifteen years. The receipts of seven of the 74 undertakings were not sufficient to cover their working expenses.

Regarding depreciation, the circular informs us that the sum placed to depreciation and reserve, and in some cases devoted to expenditure of a capital nature, amounted to £318,504, or an equivalent of rather less than 1 per cent. on the total capital expended. A moderate allowance of $2\frac{1}{2}$ per cent. for depreciation on the capital expenditure of £32,929,734, all of which cannot now be considered as productive, would amount to about £830,000. Deducting the losses, £82,161, from the profits of £478,675, there is a net balance of £396,514, or a profit of less than one-half

the sum which should have been placed to depreciation, on the very low basis of 2½ per cent. Only 96 authorities of the total of 217 provided for depreciation. It was not, however, in every case made out of profits, but was obtained in some instances by carrying an adverse balance to the account of the following year. The nine local authorities previously referred to placed to depreciation or reserve £178,509, or a little more than 2 per cent. on capital expenditure of £8,366,975. The balance—£139,995—of the total sum of £318,504, therefore, only represents about ½ per cent. as the depreciation and reserve on the remainder of the capital expenditure, amounting to £24,562,759.

In a summary of the accounts up to March 31, 1906, of the electric light undertakings carried on by London Borough Councils, published on the authority of the London County Council, it is shown as the general result of the fourteen undertakings (excluding Bethnal Green, which did not give a supply, and St. Marylebone) that since their establishment contributions from the rates had been made amounting to £63,806. On the other hand, contributions in relief of the rates had only totalled to £28,452; but the allocation of £18,220 of this sum by the St. Pancras Council has been stated to be premature. On the fourteen undertakings, none of which has been started since 1902, there had been altogether devoted to replacements, written off capital expenditure, or standing to the credit of renewals and reserve funds £184,053, or little more than 5 per cent. on a capital expenditure of £3,608,121. Battersea and Woolwich had no renewal or reserve fund.

WORKMEN'S COMPENSATION STATISTICS.

Of much the same character as previous reports are the Home Office statistics of proceedings during the year 1906 under the Workmen's Compensation Acts, 1897 and 1900, and the Employers' Liability Act, 1880. The tables contained in the return give all the information which is available; but it is, of course, impossible to make the particulars anything like complete, inasmuch as, in the majority of cases, compensation is settled by agreement between the parties concerned, in which event no official figures are procurable. Thus the report perforce leaves untouched the great bulk of the instances in which compensation is paid to workmen. It may be mentioned that the comparatively limited sources which provide the data given are the following: Returns by the Registrars of cases which come before the County Courts, and of instances in which memoranda recording agreements or awards by private arbitrators under the Workmen's Compensation Acts are registered; certain particulars of cases carried to appeal, supplied by the officers of the Supreme Court; particulars of all official references to Medical Referees, available in the Home Office; details as to certified schemes, obtained from the Chief Registrar of Friendly Societies; and certain information as to the charge for compensation incurred by railway companies, which is available from the returns made by the companies to the Board of Trade. The report is divided into three portions, covering respectively England and Wales, Scotland, and Ireland.

Taking England and Wales first, we find that in 1906 the number of cases under the Workmen's Compensation Acts that were actually dealt with by County Court Judges and County Court Arbitrators was 1718; and of these 1494 were decided by Judges and 74 by a Special Arbitrator, while 240 cases were settled by acceptance of money paid into Court. In addition to the cases adjudicated upon, there were 814 which were withdrawn, settled out of Court, or otherwise disposed of in such a way as not to enable the officials to state definitely the results. The total number of cases taken into Court was thus 2532, as against 2469 in 1905, and 1347 in 1899. As to the nature of the decisions come to, it may be remarked that of the claims settled within the cognizance of the Courts, 1179 cases resulted in favour of the applicant, and 245 in favour of the respondent. The proportion of successful claims was thus 83 per cent., which figure compares with 82 per cent. in 1905 and 1904, and 84 per cent. in 1903. The number of cases in which compensation was awarded on account of the death of workmen leaving dependants was 553; the corresponding figure for 1905 having been 538, and that for the first complete year during which the Act was in operation (1899) 219. The total sum awarded last year in the 553 cases of death in which the deceased left dependants, was £105,454; and the average amount was £190 13s. 11d.—slightly more than in any of the preceding seven years. This includes both cases in which the deceased left persons wholly dependent (in which the Act stipulates that the compensation shall range between £150 and £300), and those in which partial dependants were left (when the compensation is to be proportionate to the injury to these partial dependants). There were 111 instances in which amounts of less than £150 were awarded; the total being £9263, or an average of £83 9s.

Coming to the cases of injury, the assignment of a weekly sum was again the most general method adopted; there having been 124 cases in which the compensation was returned as consisting of a lump sum, and 501 in which a weekly payment was fixed. In 17 of the cases in which a lump sum was paid, the claimants accepted the amounts paid into Court; while in most other instances the award of a lump sum was apparently made by consent of the parties. The average amount was £36 3s. 11d. Unfortunately, as regards weekly payments, though the rate assigned is given, it is only possible in a few cases to state the length of time covered by the payments; and therefore a complete calculation of the capitalized value of the grants is out of the question. However, with the mutually agreed schemes certified by the Chief Registrar of Friendly Societies, the average duration of cases of incapacity lasting more than a fortnight (excluding those which continued for a period of over six months) was 5·2 weeks. This may be taken as a rough guide, to some extent, though it is pointed out in the report that the average duration of contested cases would doubtless be higher. In cases of injury in which weekly sums were assigned last year, the average amount per week in instances of total incapacity was 11s. 6d., and in those of partial incapacity 9s. 10d. The Acts of 1897 and 1900—to which, of course, the present returns apply—embraced forms of employment which are placed under seven heads. These are railway, factory, mine, quarry, engineering work, building, and agriculture. Of the total number of cases taken into Court in 1906, nearly one-half came under the heading of "factory"—that is to say, 1183 out of 2532.

The next set of particulars given are those gathered from memoranda registered in County Courts, having reference to cases settled by agreement or private arbitration. It is shown that 5096 cases were settled by agreement, 68 by committees representative of employers and employed, and 7 by an agreed arbitrator. The number of instances in which memoranda have been registered in this way has steadily increased year by year—the total having been 4317 in 1905 as compared with 5171 last year. In these agreed cases, the average compensation awarded to dependants in connection with fatal accidents was last year £167 9s. 7d.; while the average weekly payment in instances of incapacity was 13s. 3d. A lump sum for incapacity was fixed upon in 1564 cases, and a weekly payment in 2229 cases. The average lump sum compensation paid was £41 13s.

Another division of the report is devoted to cases under the Employers' Liability Act; and these statistics are simpler than the foregoing, because there are no arbitrators (all cases come into Court), and the damages awarded can always be stated as a lump sum. Last year witnessed a still further falling off in the number of actions brought under the Act; the figure being 476, as compared with 481 in 1905, 598 in 1904, and 688 in 1897—the year of the passing of the first Compensation Act. Of the 476 cases last year, judgment was given for the plaintiff in 114, and for the defendant in 83—leaving 279 which were "otherwise disposed of." The amount of damages awarded was £9342. Perhaps some explanation of the falling off in the number of cases under the Employers' Liability Act is to be found in the amounts awarded in 1904 and 1905 in connection with proceedings regarding fatal accidents under that Act, as compared with those taken in accordance with the provisions of the later Statute—the Workmen's Compensation Act. If this is so, however, last year's awards may do something to modify these ideas; for the average amount of damages given in 1906 under the Employers' Liability Act, in case of death, was £192 13s., as against the £190 13s. 11d. under the Workmen's Compensation Acts. Proceedings under the latter, however, again proved the more advantageous in the matter of expense.

Just over 2 per cent. of the cases under the Compensation Acts that came before County Courts were taken to the Court of Appeal. To be precise, the number was 57, as against 97 the previous year, and only 34 in 1904. Of the total of 57 appeals last year, 35 were by workmen, and 22 by employers. Five of the former and five of the latter were successful; while 19 appeals were abandoned, withdrawn, or settled out of Court. Two cases were taken to the House of Lords—both by workmen; and in one instance the appellant was successful. The points over which the appeals arose are instructive reading; and glancing down the list, one is struck by the frequency with which "Definition of the word 'factory'" appears. The two appeals which were heard by the House of Lords turned on the meaning of the words "serious and wilful misconduct" and "on, or in, or about an engineering work."

With regard to Scotland, it is stated that during 1906 the number of cases taken into Court under the Compensation Acts was 370, or 82·7 per million of population, as against 77·8 cases per million in England. The cases under the Employers' Liability Act numbered 155, or 34·7 per million of population, as compared with 14·6 cases per million in England. In cases of death, the average amount paid in compensation where dependants were left was £171 15s. 10d. when decided in the Sheriffs' Courts, and £189 10s. 2d. where memoranda were registered. In cases of incapacity, the lump sum figures were respectively £8 7s. 5d. and £31 12s. 9d., and the weekly payments 10s. 10d. and 13s. 2d. In Ireland there were last year 256 cases under the Compensation Acts, against 187 in 1905. The average amount of compensation in cases of death with dependants was £130 14s. 9d. when decided in the County Courts, and only £75 13s. 5d. where memoranda were registered. In connection with claims for accidents causing incapacity, the lump sum figures were respectively £20 12s. 9d. and £68 18s. 5d., and the weekly payments were 9s. 3d. and 10s. 11d.

The late Sir William Henry Perkin left estate valued at £78,611 gross, with net personalty amounting to £25,727. By his will, he has left all his scientific apparatus, specimens, books, manuscripts, and calculations on chemical subjects, to his three sons.

METROPOLITAN WATER BOARD.

The Fourth Annual Report.

In the "Journal" last week, we gave some statistics in regard to the supply of water to the Metropolis in the year ending the 31st of March last, extracted from the fourth annual report of the Metropolitan Water Board, which has lately been issued. We now deal with the engineering features of the report.

It is satisfactory to find that the Board recognize the importance of the storage of water, not only as a provision against dry seasons, but also to ensure the quality of the water, and that they have given this matter their most careful consideration. The Director of Water Examinations (Dr. Houston) has pointed out that if water is stored for weeks or months, the probability of harmful bacteria surviving becomes excessively remote; and he states that "water stored sufficiently long, even if turbid or unpalatable, is, in the light of present knowledge, incapable of giving rise to epidemic disease." We are pleased to put this statement on record, as it supports views which have been expressed from time to time in our columns. We confess to a belief in the *vis medicatrix naturæ*, especially in relation to the self-purifying power of water when left for a time undisturbed. It should be gratifying to residents in London to learn that the effective amount of storage and subsidence reservoir capacity for unfiltered water possessed and in use by the Board at the end of the year covered by the report was as follows :—

	No.	Area in Acres.	Total Capacity in Million Gallons.
Thames Valley	30	918·50	6345·5
Lea Valley	17	530·25	2499·2
Total	47	1448·75	8844·7

During the year, the number of reservoirs was increased by four (those at Walton and Kempton Park), with an area of 187·5 acres and a capacity of 1498 million gallons. To the totals given in the above table may be added the following, in the New River district, which are included in the monthly reports of the Official Water Examiner (Mr. Charles Perrin, M.Inst.C.E.) :—

	No.	Area in Acres.	Capacity. Million Gallons.
Hampstead and Highgate ponds	12	28·75	29·0
Camden Park reservoir for the pond water	1	1·00	0·9
Cheshunt (disused)	2	18·50	39·0
	15	48·25	68·9
Making a total of	62	1497·00	8913·6

In two tables appended to the report are given particulars as to the distribution of the Board's storage reservoirs among the several districts, their average capacity per acre, and the number of days' supply they represent according to the supply in the year 1906-7. The average capacity per acre ranges from 8·561 million gallons in the Southwark and Vauxhall division and 7·872 million gallons in the Staines reservoirs to 2·898 million gallons in the New River district, or 1·689 million gallons excluding the Kempton Park reservoirs; the general average being 5·954 million gallons per acre. The number of days' storage is 39·62 for the whole area, compared with 34·02 days last year, notwithstanding an increase in the supply of 7 million gallons a day. In the eastern district, the storage capacity represents 57·19 days; and in the Southwark and Vauxhall division, 51·12 days. The tables also show the quantity of water in store at the end of each month, the increase or decrease between the beginning and end of the year, and the number of days on which no river water was abstracted.

Two large reservoirs at Walton, which were commenced by the Southwark and Vauxhall Water Company in 1901, were completed during the year 1906-7, and were formally opened by the Chairman of the Board on the 13th of April last, as recorded in the "Journal" at the time. The Board have named the reservoirs the "Knight" and "Bessborough" respectively, after Lord Bessborough, one of the Directors of the Southwark and Vauxhall Company, and Sir Henry Knight, the Chairman of the Company at the date of the transfer. The "Knight," or western, reservoir has a capacity equal to 480 million gallons, and a water area of 51½ acres; and the "Bessborough," or eastern, reservoir has a capacity of 718 million gallons and a water area of 74 acres. The work entailed 1½ million cubic yards of general excavation, the same quantity to form the embankments, 200,000 cubic yards of puddle, and 75,000 cubic yards of portland cement concrete. The lining of the reservoirs contains 13,000 superficial yards of brick paving and 13,000 lineal feet of coping—equal to nearly 2½ miles. The cost of the work was approximately £419,000.

The intake for the reservoirs consists of three tunnels, each 12 feet by 8 ft. 6 in., commanded by three "Stoney" sluices with screen chamber and other accessories. The machinery for this station will be capable of pumping 100 million gallons from the river every 24 hours for the supply of the reservoirs. Connecting these works with the existing reservoirs and the filters at Hampton are two lines of mains, each 48 inches diameter, which have been laid to a point on the southern bank of the River Thames, whence they descend by means of a cast-iron shaft to a tunnel under the river, through which the mains pass to the northern side, where they are to be connected with the Staines reservoirs. The whole of the works were designed and superintended by Mr. Restler, the Board's Deputy Chief Engineer, and formerly Engineer to the Southwark and Vauxhall Company.

The East London Water-Works Act of 1900 authorized the construction in the Lea Valley of two storage reservoirs of a total capacity of 5000 million gallons. Practically the whole of the land required for the reservoirs has been purchased, the total cost of acquisition being £76,064, of which £22,071 has been expended by the Board since they entered into possession of the undertakings. The total area of the site is about 980 acres. The time for the construction of the reservoirs has been extended to seven years from the passing of the Board's Act of last year. In November the Board determined to proceed with one of the reservoirs (to contain 3000 million gallons), and the necessary plans are in course of preparation; an estimate of £550,000 for the work having been approved.

Under the Lambeth Water-Works Act, 1900, the Board are authorized to construct a reservoir of an approximate capacity of 1000 million gallons on land at Island Barn, situated in the parishes of East Molesey and Walton-on-Thames. The time specified for the completion of the reservoir expired on the 30th of July last; but provision is made in the Board's Various Powers Bill of the session just closed for the extension of this period for seven years. The approximate estimate of the cost of the reservoir is £250,000; and the Board voted this sum for the work.

The total storage in existence, in course of construction, and authorized, but not commenced, is as follows :—

	Thames. Million Gallons.	Lea. Million Gallons	Total. Million Gallons.
Existing storage	6345·5	2538·2	8,883·7
In immediate contemplation	1000·0	3000	
Authorized by Parliament, but not yet commenced	—	2000	6,000·0
Total	7345·5	7538·2	14,883·7

The 8883·7 gallons of existing storage is exclusive of the Hampstead and Highgate ponds and the Camden Park Road reservoir for pond water.

Another table shows the working of the Staines reservoirs—viz., the average daily supply, total volume delivered each month to the New River and western districts (Grand Junction and West Middlesex divisions), and the quantity in store at the end of each month. The actual quantity of water supplied from these reservoirs during the year 1906-7 was 7901·8 million gallons, or a daily average of 21 6 milliou gallons, of subsided water—an increase of nearly 29·5 per cent. over the preceding year. Of the total quantities supplied from the reservoirs, the New River district took 15 per cent. and the western district the remainder. In the Board's second and third annual reports, reference was made to the Kempton Park storage reservoirs, which had been commenced by the New River Company in order to enable them to utilize their right to one-third of the water from the Staines reservoirs. The two reservoirs at Kempton Park, having a joint capacity of 300 million gallons, and with an area of 62 acres, were brought into use during the year; the New River district first taking water from the Staines reservoirs for filling Kempton Park reservoirs on April 30, 1906. On Dec. 3, 1906, the Kempton Park pumping-station and reservoirs were used for the first time for affording a supply to the eastern district; the Thames intake of that district at Sunbury having been closed from that date.

In April, 1905, the Board approved an estimate of £152,400 for the completion of the Staines (New River) communication works. A tender has been accepted for £23,532 for the making, testing, and delivery of the 42-inch and other cast-iron pipes required for the portion of the aqueduct between Child's Hill and Cranley Gardens (Fortis Green), and a further tender of £27,425 for the laying of the main. Tenders for the sluice-valves in connection with the aqueduct from Child's Hill to Cranley Gardens and with the Fortis Green reservoirs have also been accepted, amounting to £2132. A tender of £60,279 was accepted in July, 1906, for the construction of the two service reservoirs at Fortis Green in connection with the Staiues reservoirs communication works; and another for £4472 for making, testing, and delivering 42-inch and other cast-iron pipes and castings required in connection with the reservoirs.

In connection with the Staines reservoirs communication works of the New River District, the Board have had to consider the improvement of the supply to that district in view of the addition of Tottenham and Enfield, and of the rapidly increasing population. The Board adopted a scheme arranging for the delivery of an additional daily quantity of 10 million gallons of unfiltered water from the East London reservoirs into the New River channel at Stoke Newington *vid* the old 36-inch main from which the New River Company used to obtain water from below Tottenham Mills more than forty years ago. To enable this 10 million gallons to be lifted into the New River channel, a steam-turbine pump, with accessories, was authorized to be fixed at the Ferry Lane station of the eastern district. The Board hope that with the completion of the main from Child's Hill to Cranley Gardens and thence to Hornsey (which latter portion alone remains to be commenced) considerable improvement will be effected in the water supply to the New River district, and consequential relief afforded in other districts.

Coming to the subject of filters and filtration, it was reported

last year that the Board had authorized the construction of new filter-beds at Hampton, of about 6 acres in area, to improve the supply to the district, at an estimated cost of £60,000. Seven new beds at Hampton were finished and taken into use in November, 1906. During the year the Board authorized the construction of another six beds at Long Ditton, of a water area of 7¾ acres, together with a supply-tank to be constructed at Dittou. The approximate cost of these works was estimated at £85,000. Tenders have been accepted and the work is in progress. Tenders have also been accepted for the construction of filter-beds at Barn Elms, to increase the filtration area for the district taken over from the West Middlesex Company, at the sum of £15,750 (*plus* £450 should it be found necessary to provide a jetty in connection with the work), and for the provision of the necessary castings. Twelve filter-beds at Kempton Park, with an area of 9 acres, were brought into use during the year. Nineteen new filter-beds of 16·75 additional acreage were brought into use during the year. The total number of filter-beds is 161, or 161·91 total acreage, or 0·85 acre per million gallons average daily supply of filtered water; the latter figure ranging from 0·41 in the New River district to 1·35 in the Grand Junction division. The average monthly rate of filtratiou per square foot per hour during the year varied from 0·903 gallon in the Grand Junction division to 2·54 gallons through the New River beds.

An interesting table is one giving particulars of the number and capacity of the service reservoirs for filtered water (as distinct from storage reservoirs for raw water) in each district. The total number of service reservoirs is 78, of 243·142 million gallons total capacity. Of these, two only, situated at Hanger Hill, Ealing, of 53 million gallons capacity, are uncovered. In addition to these, reservoirs of 67 million gallons total capacity are in course of construction at Honor Oak, Fortis Green, and Southfleet. In view of the rapid increase of population in the district supplied from the Woolwich Common reservoir, the Board are extending the 18-inch main from Crayford to Plumstead Commou as far as this reservoir; the length of the extension being 3000 yards, and the estimated cost £5750. As the only possible means of improving the supply to the high-level parts of Norwood and Croydon (there being no other land available sufficiently high on which a reservoir could be built for the purpose), the Board took a lease for 99 years of one of the two high-level tanks adjoining the Crystal Palace Parade. Negotiations were subsequently entered into for the acquisition of the freehold of the land on which the tank is built; and it was agreed that the Board should pay the sum of £7000 for the freehold of the property. The tank has a capacity of 207,000 gallons, and the top water-level has an altitude of 437 feet.

Another table appended to the report contains a summary of works authorized during the year in the several districts, classified according to the description of the works, and showing the authorized expenditure in respect of each. Certain works for the protection of the Board's New River mains were carried out at the expense of the Middlesex County Council, in accordance with section 34 of the County of Middlesex (Waltham Cross and Enfield) Light Railways Order, 1905, and opportunity has been taken during the construction of these works to proceed with the culverting of the New River at Southbury Road, Enfield.

The New River Company's Act of 1896 authorized the carrying out of certain works of river enlargement in the neighbourhood of the Amwell Marsh and Amwell Hill pumping-stations, for the purpose of remedying a considerable source of leakage (estimated at about one million gallons per day) which was taking place in this particular length of the river by percolation into the chalk. The work had been commenced by the New River Company; but was not completed owing to the imminence of the transfer of the undertaking to the Board. The Board have therefore now authorized the remainder of the work to be put in hand. It comprises the concreting of a length of about 370 yards in the channel of the river, at an estimated cost of £3300, and a length of about 150 yards of river channel opposite the Amwell Hill pumping-station, as well as the reconstruction of the Amwell Hill sluice controlling the river at this point—the estimated cost of the latter part of the work being £1500.

With regard to the distributing system, the total length of mains *in situ* at the end of the year 1906·7 was nearly 6044 miles; including 3 miles of Staines mains. The various diameters are given in a table, which shows that the pipe mostly in use is the 4-inch. The length of new mains laid during the year was upwards of 96 miles. The largest extensions were in the New River and Kent districts—being 29·8 and 20·7 per cent. respectively; while less than a mile was laid in the Chelsea division. The length of new mains laid per additional service varied from 30·4 yards in the Chelsea division to 5·4 yards in the eastern district; the figure for the whole area being 9·3 yards.

The Board possess 91 pumping-stations in all, of which 54 are for wells and 37 are stations other than wells. The number of engines is 257, having a total of 34,645 H.P. There are 130 engine-houses and 512 boilers. These figures are exclusive of the equipment of small auxiliary work. The total quantity of coal burnt during the year was 170,266 tons, equal to 2·07 tons per million gallons of water supplied; each ton representing 482,335 gallons of water supplied. The consumption was lowest in the eastern district—viz., 1·53 tons—compared with 2·81 tons per million gallons supplied in the Lambeth division; that is to say, each ton represented 651,864 gallons supplied in the former case against 356,103 gallons in the latter. In the Kent district, where all the water has to be pumped vertically from the wells, the consumption was 2·54 tons per million gallons supplied. The southern district used 31·982 per cent., and the western district 25·027 per cent., of the total coal consumption.

As bearing closely upon the purity of the water supplied to London, the portion of the report dealing with the sewage schemes in which the Board are concerned, claims attention. Their third annual report contained an explanation of certain contemplated sewage-diversion works in the Lea Valley, and the circumstances which led the Board to withdraw their proposals as contained in their Bill of the session of 1906. In May the Board received a letter from the Local Government Board enclosing a copy of a resolution passed at a conference between representatives of the Hertfordshire County Council and of the Urban and Rural District Councils in the Lea Valley, stating that the various local authorities were prepared to carry out such works for sewage disposal as the Local Government Board might consider to be necessary, and to bear their fair share of the cost, on condition that the Water Board should bear any portion involved in bringing an otherwise good effluent up to the standard which should render the water of the Lea a source quite beyond suspicion of water supply for London. The Local Government Board stated that the question of requiring additional means of purification had arisen in the case of two sewage schemes for places above the East London intake—viz., Sawbridgeworth and Harlow; and the Board desired to be informed whether the Water Board would be prepared to meet the cost of any additional works required in these cases, or to make a contribution towards the cost, and generally what were the Board's views on the question of such contributions. The Local Government Board were informed that, subject to the consideration of special circumstances in any particular case, the general view of the Water Board was that if local authorities efficiently maintained and carried on such works of sewage purification as were usually required by the Local Government Board when sanctioning loans under the Public Health Act, 1875, no additional means of purification would be required so far as the Water Board were concerned.

As mentioned in the third annual report, in accordance with the terms of a lease made between the Corporation of Hertford and the East London Water-Works Company, the Board are, as successors of the Company, responsible for the treatment and purification of the sewage of Hertford. In accordance with the terms of the lease, a scheme for the construction of new works was prepared by the Company, and application was made by the Hertford Corporation to the Local Government Board for sanction to the borrowing of £27,000 for the purpose. During the consideration of the Lea Valley scheme, the question of the construction of the proposed new sewage works at Hertford remained for some time in abeyance. By the New River Company's (Hertford Sewage Diversion) Act, 1854, the sewage must, before being discharged into the Lea, be subjected to "the then best known practicable process" for its purification; and it further provided that, in the event of any question arising as to what process shall be adopted, the Board of Trade may determine the matter by a declaration, and such declaration is to be conclusive until superseded by a subsequent one.

Acting under these powers, the Board of Trade, in May, 1904, declared that "the then best known practicable process" for the purposes of the Act was septic tank treatment, followed by double contact beds and final filtration of the effluent through sand; and plans had been prepared on these lines. In November, 1906, the Water Board asked the Board of Trade to supersede their declaration of May, 1904, by another one prescribing as the best known practicable process for the purification of the Hertford sewage the passing of it through detritus tanks, followed by septic tank treatment and the sending of the resulting effluent through percolation filters.

The Water Board have since received a letter from the Board of Trade suggesting, in view of the fact that the duty placed upon them by the Act of 1854 is now outside their ordinary functions, that provision should be made in the Board's Various Powers Bill to transfer to the Local Government Board their powers and duties under sections 8 and 9 of the Act of 1854 referred to, and enclosing a copy draft clause to which the Local Government Board had given their concurrence. The Law and Parliamentary Committee were therefore instructed to secure the inclusion of the proposed provision in the Board's Various Powers Bill of this year, which received the Royal Assent last Wednesday.

The remainder of the report is devoted to miscellaneous matters, including the settlement of uniform scales of charges for water, reviews of the parliamentary proceedings in the session of 1906, the legal decisions that affect the Board, and some observations (with tabulated results) on the chemical and bacteriological examinations of water.

Another Rise in the Price of Coal.—As the result of a decision come to by operators on the London Coal Exchange, an all-round rise of 2s. per ton took place in the price of coal last Saturday. The main reason assigned for the increase, which is 1s. per ton more than was intended, is the action of the present Government in removing the export duty, which largely increased the foreign demands. In the opinion of many merchants, this is only the beginning of an era of high prices.

THE ILLUMINATING POWER, IN ORDINARY AND INCANDESCENT BURNERS, OF COAL GAS, WATER GAS, AND MIXTURES OF THE TWO GASES.

By M. Emile Sainte-Claire Deville.

[Abridged Translation, with Comments, by W. J. Atkinson Butterfield, M.A., F.I.C., of a Communication presented to the Meeting of the International Photometric Committee in Zurich, July 18 to 20.]

(*Continued from p.* 576.)

Second Memorandum (Dated February 16, 1905).

THE ILLUMINATING POWER IN INCANDESCENT BURNERS OF COAL GAS COMPARED WITH THAT OF WATER GAS AND OF MIXTURES OF THE TWO.

Definitions.—Having measured the absolute intensity (I) of the light of an ordinary incandescent burner at the rate of consumption (G) per hour, the illuminating duty of the burner will be $\frac{I}{G}$, and may be expressed in carcels per 100 litres, or litres per carcel (or, say, candles per cubic foot, or fraction of a cubic foot per candle). If C is the calorific power of the gas used, then $C \times G$ expresses the heat expended in one hour under the mantle, and the ratio $\frac{I}{C \times G}$ will represent the illuminating duty of the heat, which may be expressed in carcels per 1000 calories (or candles per 1000 B.Th.U.). For instance, gas having a calorific power of 5000 calories per cubic metre, when burnt at the rate of 110 litres per hour in an ordinary Welsbach burner, may give an absolute intensity of light of 6 carcels (or, say, gas of 562 B.Th.U. per cubic foot, at the rate of 3·88 cubic feet per hour, may give 58·8-candle power). The illuminating duty of the gas will be 5·45 carcels per 100 litres, or 18·3 litres per carcel (13·75 candles per cubic foot); or 10·9 carcels per 1000 calories, or 91·5 calories per carcel (about 37 B.Th.U. per candle).

Burner with Artificial Air-Supply.—The duty just referred to is that which an ordinary burner affords when it draws its air supply from the atmosphere around it by reason of the joint action of the bunsen injector and the chimney draught. But it matters not by what means the efflux and admixture of gas and air in question have been achieved; and the duty will be the same if the same efflux and admixture are brought about under the same mantle from a burner to which the air is fed artificially. A burner so arranged that the air supplied could be measured just as the gas consumed is measured has been used by the author for the researches of which an account was published four years ago.* Herr Winkler also has made similar measurements of the natural air supply to gas-burners by the aid of his ingenious and elegant method involving the use of a tube with a plug of smoke.† [The plug of cigar smoke is introduced into a wide glass tubulure attached to the side of the vessel through which the air supply which it is desired to measure passes to the burner. The outer end of the tubulure is open, and the plug of smoke therefore remains stationary only if the air supply passing over the other end of the tubulure is at precisely atmospheric pressure. If the air supply is either above or below the atmospheric pressure, flow of air through the tubulure naturally occurs, and the plug of smoke passes with the current of air outwards or inwards. Thus assurance is obtained that the air supply which is being measured is under the normal—*i.e.*, atmospheric—pressure at which the air is supplied to the burner in the ordinary conditions of use. There are obvious objections to the use of cigar smoke in a room in which photometric observations have to be made; and, moreover, the plug of smoke has to be replaced by blowing a fresh supply into the tubulure every time it may happen to have been expelled through a change in the pressure of the air supply causing a flow of air through the tubulure. It may therefore be useful to refer to the fact that Mr. C. Vernon Boys has employed a different indicator, which is free from these objections. It is a modification of a device used nearly twenty years ago by him and two other physicists for indicating the flow of air through a tube, in connection with an investigation which required an indicator of a far higher degree of sensitiveness than is needed for observing the air supply to gas-burners. Their object was the measurement of the heat developed by the ether waves which are now used in spark telegraphy; and that heat was detected and measured through the air current which it produced. At first they availed themselves of the oxide of phosphorus which is continuously produced by the slow oxidation in air of a tiny speck of phosphorus. The oxide falls slowly in the form of a thin white line, which closely follows any movement of the air. But even this indicator was scarcely delicate enough for that investigation, and Mr. Boys then devised one consisting of a light plane mirror suspended eccentrically by a quartz fibre in a cylinder of slightly larger diameter, and balanced by a counterpoise screened from the influence of the air pressure. Any flow of air through the cylinder at once deflected the mirror. A few years ago, he adapted this indicator for use in the tubulure of Winkler's apparatus in place of the plug of cigar smoke, and the translator has been much impressed by the advantages it affords in use over the latter. A half-moon shaped vane of paper or thin card is suspended eccentrically by means of a delicate torsion fibre—*e.g.*, a filament of spun glass—and is balanced by a small lead counterweight. It is suspended in a slightly larger opening in a diaphragm placed across the tubulure, and when unmoved by air currents sets in the plane of the diaphragm so that it nearly fills the opening in the latter. The slightest difference of pressure of the air on the two sides of the diaphragm deflects the vane, and the air flows through the opening. The amount of deflection is roughly a measure of the air-flow. When the air in the tubulure once again becomes still, owing to the air within the apparatus being precisely at atmospheric pressure, the vane returns to its neutral position across the opening, in which position there is no torsion on the fibre. Winkler's apparatus, with this torsion vane indicator, appears to afford by far the most satisfactory means of measuring the air supply under normal conditions to gas-burners; but other arrangements—such as that of M. Sainte-Claire Deville and that used by Mr. Charles Carpenter in his investigation of the Metropolitan Argand-Burner No. 2*—may be convenient in particular cases. The paper in which the use of oxidizing phosphorus and of a balanced vane hung eccentrically by a torsion fibre to indicate the flow of air through a cylinder were first described by Mr. Boys and his two collaborateurs, is to be found in the "Philosophical Magazine" for January, 1891. The idea of using the deflection of an indicator by air-current produced from a very small quantity of heat for detecting the latter, was taken from Dr. Joule.]

By reproducing artificially by means such as those mentioned the conditions of ordinary combustion in a burner, it is in the power of the operator to control and vary both the gas and air supply, and to study the resulting effects.

Variation of Duty with the Supply of Air, the Gas Consumption remaining Constant.—With the gas consumption fixed, it is easy, by turning the tap on the air meter, to adjust the air supply to that which affords the maximum duty, and so to find the ratio of air to gas $\left(\frac{A}{G}\right)$ corresponding to this maximum. The following figures for a small ("Bébé") mantle, Brand A, No. 3, were obtained in December, 1904, with coal gas having a calorific power of 5216 calories per cubic metre (586 B.Th.U. per cubic foot), and requiring 5·471 times its volume of air for complete combustion.

Table III.

Consumption of Gas. Cubic Feet per Hour.	Volumes of Air per Volume of Gas.	Illuminating Duty.	
		Candles per Cubic Foot.	B.Th.U. per Candle.
2·19	2·64 (*a*)	11·4	46·6
,,	3·06 (*b*)	16·2	32·9
,,	4·19 (*c*)	11·4	46·6
4·24	3·62 (*a*)	11·0	48·4
,,	4·73 (*b*)	25·4	20·9
,,	5·98 (*c*)	11·3	47·3
7·77	4·35 (*a*)	19·5	27·4
,,	4·83 (*b*)	24·6	21·6
,,	5·22 (*c*)	20·3	26·3

(*a*) inadequate air supply; (*b*) correct do.; (*c*) excessive do.

Variation of Duty with the Consumption of Gas.—Starting with a relatively low rate of consumption of a particular gas under a particular mantle, and increasing it by stages, while regulating the air supply at each stage to that which affords the maximum yield of light for that rate of gas consumption, it will be found that these maximal yields rise rapidly till they attain, and then maintain for a certain time, an absolute maximum value, and afterwards fall slowly. The corresponding proportions of air increase up to the point of absolute maximum value and beyond that they remain without any change. The limiting value corresponds to about 90 per cent. of the proportion of air theoretically required for the complete combustion of the gas. When the variations of yield so observed are plotted out graphically as functions of the consumption of gas, the curve takes the course shown (with a little rounding off for the sake of clearness) in fig. 1. From A to B, there is a rapid increase in the duty and in the proportion of air; from B to C, the duty is maintained at its absolute maximum—*i.e.*, the light increases in direct proportion to the consumption of gas; and from C to D, the light and the temperature of the mantle continue to increase, but less quickly than the consumption of gas, and consequently the duty falls. From B onwards, there is no increase in the proportion of air.

* See "Journal," Vol. LXXXIII., p. 617.

† This method was described in the "Journal," Vol. LXXXVII., p. 803.

* See "Journal," Vol. XCIV., p. 887, and Vol. XCIX., p. 235.

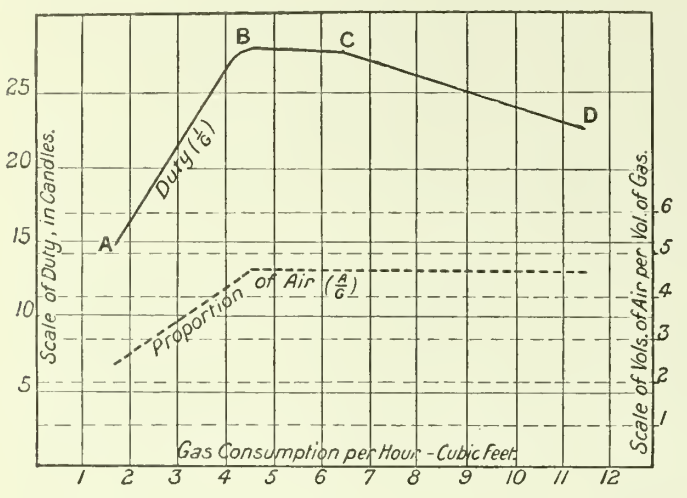


Fig. 1.

Effect of the Size of the Mantle.—The effect of the size of the mantle may be seen from the results of series of tests made with the same gas according to the last-named plan, but using mantles of gradually increasing dimensions, as, for instance—

Mantle.	"Bébé."	No. 1.	No. 2.
Length.	1·97 inches	2·36 inches	2·95 inches
Diameter at top	0·67 ,,	0·67 ,,	0·87 ,,
,, ,, bottom	0·79 ,,	0·91 ,,	1·26 ,,
Surface—vertical projection . .	1·43 sq. in.	1·74 sq. in.	3·10 sq. in.
Cubic contents of interior . . .	0·81 cub. in.	1·16 cub. in.	2·56 cub. in.

The variations in the yield of light as a function of the consumption of gas are governed by laws which will be referred to later; but it will be seen from the curves in fig. 2 for the three

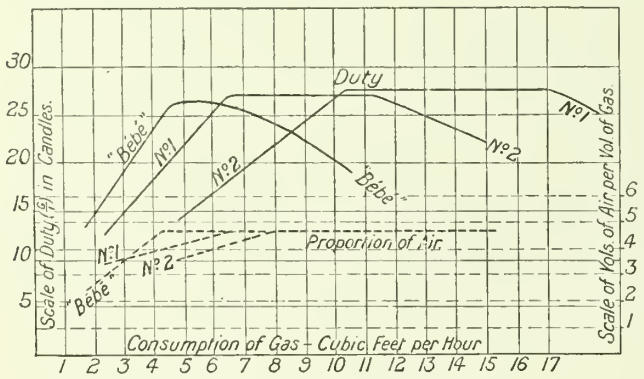


Fig. 2.

mantles of which the dimensions have been given how they become modified with increase in the size of the mantle. The absolute maximum duty augments slightly and is maintained over a greater range of consumption as the size of the mantle is increased. The proportion of air corresponding to the absolute maximum remains the same for all the mantles.

The Specific Illuminating Duty of a Gas.—The foregoing summarized statements indicate that the illuminating duty of a particular gas burnt under the same mantle may vary within wide limits. Consequently, for the comparison of the illuminating duties in incandescent burners of two different gases, it is absolutely essential to define which of the possible duties is to be regarded as the specific duty of the gas. Undoubtedly the maximum duty under a specified mantle should be prescribed as the specific duty, and it could be readily determined by the aid of a burner to which the air supply may be fed artificially. Practically when the burner is judged to be giving its most powerful light without being over-driven or making excessive noise, it will be affording its specific maximum duty, as represented by any ordinate between B and C in fig. 2. But in order that the measurement may always be made under the same conditions, some uniform type of mantle must be employed. Unfortunately, at different times and places, different operators get varying results with two gases supposed to be alike, whatever mantle of specified type and size they may have elected to use. The light will vary in accordance with a number of conditions which it would be very difficult to define; and in the existing state of the mantle industry, the author thinks it will be impossible to establish any specification for the direct determination of the illuminating power of gas in incandescent burners.

Conditions for Comparative Testings.—If, however, the only object is to find the law of variation of the incandescent illuminating duty in relation to the calorific power and the temperature of combustion of the gas, it will suffice to carry out short series of testings. It is possible in one such series to test five or six different gases without changing the mantle, or even extinguishing the flame. The maximum duty per cubic foot or the B.Th.U.'s per candle will be determined in these testings, and the results so obtained for the different gases will be comparable. Each series of testings taken by itself will afford a glimpse of the law of variation of the incandescent illuminating duty of the gases. On bringing together and comparing the results of a number of series of testings, a fairly correct idea can be formed of the effect of the calorific power or of the theoretical temperature of combustion of the gases on the value of the illuminating duty in incandescent burners.

(To be continued.)

GAS FROM STRAW.

An article in a paper with the title of the "Daily News Advertiser," Vancouver, British Columbia, affords an interesting leader under the title of "Making Gas from Straw." The graphic description by the colonial journalists of the marvels of the so-called new invention and of the praiseworthy efforts of the inventor to bring the idea to perfection, are suited to the Provincial Daily Press. There is, however, somewhat of interest—a large amount in our Colonies, and indirectly from a scientific point of view to those at home living in the old country.

Briefly, the question is this: All those interested in the manufacture of gas know that gas in the ordinary sense can be made of any material of an organic nature; but the main consideration is one of economy—viz., whether the ratio of production and profits will supply a necessary margin on a commercial basis. This is the chief issue. There are two points about gas manufacture—the gas which can be used for various purposes, and the worth of the residual products which can be recovered, and possess a certain trade value. This applies to all classes of gases—from coal, peat, lignite, shale, or wood, and all other sources. The old adage says that "circumstances alter cases."

Reverting to the manufacture of gas from straw, cob-corn husks, &c., the conditions are these: In the wheat-growing districts of the Far West, where the circumstances are very different from those which exist in the old country, straw and the husks of maize have been practically waste products. The only available product of commercial value has been the grain, which realizes a variable profit dependent upon market prices. The refuse, straw husks, &c., have been valueless, with the exception that, not being worth cartage, they have been burnt on the land, mainly with the view of getting rid of the surplus rubbish. A certain amount of value has no doubt been gained from this rough process by the restoration to the soil of some proportion of the mineral constituents necessary for the maintenance of a fresh crop.

The new aspect of the case is the utilization of these waste products in another direction—that is, for the production of gas. The statements now put forward are that in the area of Western Canada, and in the wheat-growing districts of America, it is computed that over 200 million tons of refuse products are burnt annually in the fields as waste products. Further, it is estimated that over a ton of these waste products is produced from each acre of land under cultivation. It is also stated that each ton of wheat straw refuse will produce 15,000 to 16,000 cubic feet of gas, against 10,000 feet from a ton of ordinary coal. Enriched with petroleum, this gas is claimed to be equal in value for heating and illuminating purposes to that furnished to the largest cities of America. The matter is of interest, moreover, as it is stated that Beatrice, Nebraska, has a works supplying the new gas, the consumers of which are well satisfied; and that it is proposed to extend the system to other districts in the wheat-growing area. The bye-products are stated to be coke, ammonia, wood alcohol, and acetone.

Monazite Sand and Gravel in Brazil.

The British Consul at Bahia, in his annual report just issued by the Foreign Office, gives some interesting details as to the monazite found there. He says it has lately been discovered that there exist considerable quantities of monazite gravel along the course of the Parahyba River in the interior of the State. The discovery was made by some Brazilians, who secured a concession, and have erected plant for concentrating the gravel at the places where it is found; and it is anticipated that the process, if successful, will have the effect of revolutionizing the trade in monazite. The export of sand from Bahia during the past five years (1902-6) has been as follows: 811 tons, 1862 tons, 2901 tons, 1039 tons, and 945 tons. It will be seen that the output varies much from year to year. As a matter of fact, the collecting of the sand on the exposed sea coast, and the subsequent shipping of it, frequently present many difficulties. Moreover, the amount of monazite existing in the deposit varies very much from time to time; and it would appear to be dependent in a great measure on the kind of weather which happens to prevail. Thus the proportion of sand is always greater after the prevalence of a southerly or of a south-easterly gale than at other times. It would appear from this that the main deposit of the sand in question is situated beneath the sea level, from which position it is dislodged and carried ashore through the action of certain winds and currents. Practically all the monazite sand exported from Bahia goes to Germany.

WESTERN WAYS IN AMERICAN GAS BUSINESS.

By Archibald S. B. Little (writing from St. Louis, U.S.A.).

America is the land of promise for those interested in gas-works construction, as new works are being contemplated or are in course of construction, while the increase in consumption is so great in already established businesses that retort-houses, and parts in connection therewith, are being doubled in capacity in quite a number of towns. The question, therefore, arises, How are such extensions to be executed? Let me endeavour to outline the most favoured methods which have appealed to gas engineers during the last 25 years. It may be taken that what was in vogue at the beginning of that period, still has the approval of many engineers; and therefore one may conclude, not without reason, that in America there is still a good deal to learn before gas can be made economically, be sold at (say) 4s. 2d. per 1000 cubic feet, and carry a reasonable profit to the shareholder.

Why this should be so I cannot understand, as there is no limit to the dividend which may be paid. The price of gas is fixed by the company, with little or no let or hindrance on the part of the licensing authority. It follows, therefore, that every reduction in the cost of production is a direct gain to the company. Perhaps it is owing to the fact that gas finds a ready sale at "$1 per 1000," as this means that any sort of system can be applied and still a profit can be made. Or, further, there is no time for the engineer to look around and find new and improved methods. He has all his work to do in keeping pace with new construction on established lines. I will give some idea of what is found over here in a lately-built (I cannot say modern) retort-house.

Horizontal retorts, with hand charging, is the principle most generally adopted; and the beds (always called a "bench" over here, with so many benches to a "stack") are set with from three to nine retorts each. The favourite settings are sixes in an arch measuring 8 feet between the piers; the latter being about 18 inches thick to make the beds 9 ft. 6 in. centres. It is claimed here, in the Middle-West, that the clay is equal to anything in the East or in England; and, so far as shape is concerned, a visit to several factories has convinced me that it would be difficult to find better. But relying solely on information furnished by the makers, when I try to arrive at an opinion as to its durability and capability of withstanding heat or wear and tear, all that is to be said when summed up is that something is wrong either with the clay or the way it is formed and assembled in a bench, or perhaps with the treatment it gets after passing into the hands of gas-works operatives. Benches, down to the regenerators, over here are re-set every two years; and this is considered a good performance. Drawings I have inspected appeal to one favourably in respect to the design of regenerators, except for needless complication in the flues. This is due to the everywhere accepted idea that a long zig-zig travel is required for the secondary air. The outgoing gases travel downward to and fro; and in between the flues a secondary air channel is placed—the junction between the two latter being by way of a vertical tube at the side, which is built into the side wall of the producer (and even in one case it was placed in the main pier, as shown on Sketch No. 4).

Dealing with main piers and arches, the mid-walls are 18 inches thick, and built of 9-inch by 4½-inch by 2½-inch fire-bricks (in this section of the States 3-inch bricks are unknown), while the end pier has a 9-inch wall with 2 ft. 3 in. of stock bricks as a buttress, it being bonded into the fire-brick every fifth course. The main arch is formed of 9-inch by 9-inch by 2½-inch arch bricks; and over this one to two rows of hollow tiles are laid to keep down

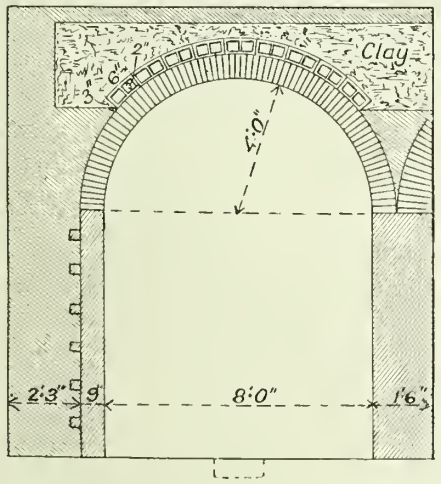


Fig. 1.—The Main Arch of a Retort-Setting.

loss of heat by radiation. Above this is a 6-inch thickness of clay, which also fills in the spandrils; and on this are built two courses of stock bricks. In Sketch No. 1, I have endeavoured to make the description clear. Sometimes a 2-inch air-space also is left between the 9-inch arch bricks and the hollow bricks; it being closed at front and back by the outside walls of the bench.

The ashpit is made of cast iron, and measures 18 inches wide, 6 ft. 3 in. long by 7 in. deep; and a peculiarity of the beds is the action of this portion. In working, the pan is filled with water; and though there is a water supply pipe laid on, this is only put into use on few occasions, so as to fill up the pan as the water evaporates. No continuous stream is used; and there is no overflow pipe. So far, I have not seen how the men get along with the clinkering. It is hardly necessary to say that no steam jets are used on this construction.

As before mentioned, the regenerators are well built of special blocks, and should (and I believe they do) work well. I propose, before concluding, to indicate the general construction when I describe some inclined settings. But before leaving the fire-clay work, I will say that the retorts are generally 9 ft. 3 in. long, with a 1-inch space, and then a 9-inch mid-wall—making the depth of a back-to-back setting 19 ft. 5 in. However, back-to-back benches are not often used, as single stacks find most favour. Through retorts are very much disliked, and are seldom used. The retorts themselves are all hand-made, 3 inches thick, with the bottom of the mouthpiece end swelled out and the top thickened internally.

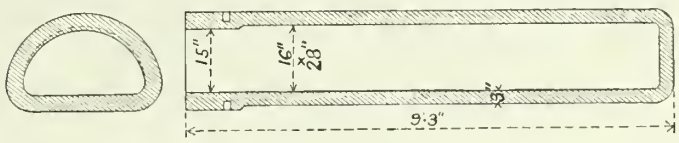


Fig. 2.—An American Retort and Mouthpiece.

This makes the cast-iron mouthpiece smaller than the retort-face, as on Sketch No. 2. The retorts are made very large—sometimes up to 19 inches by 31 inches section.

It is now my intention to describe a trial installation of inclined retorts; and in this you will be able to follow the details of iron-work as used on horizontal retorts also. For all practical purposes, the two are identical; and to describe each separately would call for more space than the "Journal" can spare.

The labour question in all parts of the States is becoming very acute; and in every trade there is great scarcity. When, therefore, a call is made for men to do the hard work in a gas-house, the response is deplorable from the manager's point of view. In some places, as much as 12s. 6d. per day is offered; but when men can get nearly as much for wrecking a building, what hope has the manager of securing a steady supply of suitable stokers? To give some idea of what tradesmen get, I may say that plumbers in St. Louis are paid $6 (25s.) a day. In a number of cases, works have been temporarily shut down owing to the inability of gas-works to find men who will do the shovelling of coal. This can lead only to one way of solving the problem; and that, of course, is the adoption of some system of construction which will require little labour, and that of an easy kind—skilled to a certain degree and not so highly-paid. Power-driven horizontal charging machinery is out of the question, as the works are in most cases small (having an output of from 150,000 to 300,000 cubic feet per day), owing no doubt to the rapidity with which towns come into being—in some cases developing from nothing to quite large proportions, with the rapidity of the proverbial mushroom. One town I recently visited was prairie 16 years ago, and now has a population of 45,000.

What class of engineer or construction, you will ask, is to be found round here, to take hold of this problem? The answer has already been hinted at in the opening portion of this article. However, I will at once say that there are a number of men here who see the need of labour-saving machinery in the gas-works of the country, and are going ahead on the right lines in an effort to overcome the adverse conditions which here and now exist, and that would otherwise cripple the industry. The plan outlined, and which is being followed, is to set up small stacks of inclined retorts. But when the schemes are examined by English eyes, practically the only thing which bears resemblance to known construction is the angle of repose. The details I am about to give show clearly the lines on which engineers are going to work; and as only sketches and outlines are given, it is as well to say this, because complete drawings would uncover to competitors the secret of the system, while they would not appeal to English engineers. The sketches show the latter the broad lines on which this first stack of three beds is being built, and allow them to make comparisons and draw conclusions—thus relieving the writer of the task of criticism or comment.

In beginning, one may make clear the fact that the problem has been approached by builders of successful horizontal retorts, and as no research has been made into past efforts on the part of foreign builders of inclines, it is not strange to find the main features of the bench bear a striking similarity to the horizontal settings. But in the new construction the retorts are inclined at an angle of 32° to the horizon.

As is usual in the Middle West, the foundations are carried only flush with the outside flanges of the buckstays, and the iron stanchions are not built into the concrete as in England; neither are the foot-plates secured to these buckstays to form a bearing. The main piers are 18 inches thick, and the end buttresses are formed of 9-inch firebricks with 2 ft. 3 in. of red brick as on Sketch No. 1. The hollow tiles, clay filling, and double course of red brick are adopted also as for horizontals. The retorts are set four in a bed, and the width through the bench horizontally is 11 ft. 10½ in., thus giving a retort 14 ft. long which it is proposed to charge every four hours with 600 lbs. of Pittsburg coal, calculated to give about 70,000 cubic feet of gas per bed per diem—the actua

amount needed being at the rate of 50,000 cubic feet. I give an idea of the house in cross section (Sketch No. 3), from which it will be seen that the building is only 28 feet wide, giving a 9 feet width on the charging floor and just over 7 feet on the drawing floor. Here let it be noted that excellent ventilation is provided for the summer months, and due protection is afforded for the severe winter ordeal when (as recently) a 4 feet fall of snow is often found and leads to occasional drifts around the retort-house up to 18 feet deep.

The retort-house shown in Sketch No. 3 is 64 feet long, suitable for three beds of fours. It has twelve glazed windows 5 ft. 6 in. by 3 ft., and a louvred top to the roof 50 feet long. The wall on the drawing side has four openings, 8 ft. by 6 ft., provided with rolling steel doors. It is built in one with the condenser house, purifier house, and meter house; a 12-inch wall separating each from the adjoining portions. Strange to say, the purifier house is closed except for a 24-inch star ventilator in the roof. Light is obtained from four glazed windows, which measure 5 ft. 6 in. by 3 ft. There is also one door measuring 6 ft. 6 in. by 3 ft.

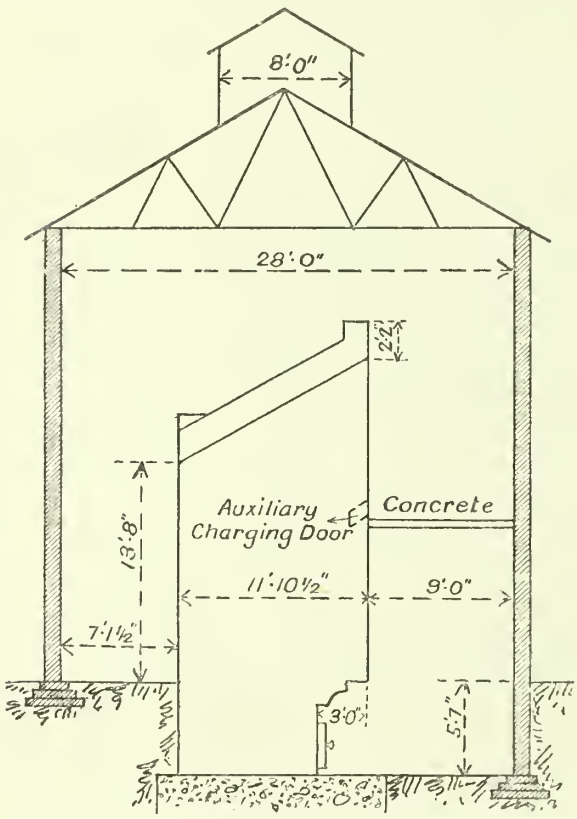


Fig. 3.—Cross Section of an American Retort-House.

As to the details of the regenerators, English engineers will no doubt find a deal of strangeness, and the elaboration of special flues (requiring many difficult and costly blocks), which entail a lot of skilled labour in the laying, making the scheme one that will not appeal to your readers. As I hinted before, the lines of the old horizontal work have been followed; and so long as gas companies are willing to pay for intricate work such as this is, then there is no reason why these costly constructions should not be adhered to after adjustments have been made to render them suitable for inclines. Sketch No. 4 shows the construction of one regenerator and producer, and attention may be called to the unique and perhaps objectionable method of putting flues in the main piers, to connect the secondary air passages.

The system, in ordering from the factory, is to number all the blocks and tiles below the retort level, and to letter all the special blocks for the seating and holding-in of retorts. Hardly an ordinary "square" is used in setting a regenerator; and even in the main piers and the arch covering, a number of specials are adopted to supplement the squares.

I note that the main flue (separate entirely from the bench) is rather small, as the primary air inlets measure 6¾ in. by 7¼ in., and take six flues in three beds. This gives a total of 293·4 inches. Then the secondary air inlets measure 9 in. by 6 in., giving for the three beds 324 square inches in section. The two together total 617·4 inches.

The combination of air and gas (heated) has to pass through a main flue, 22½ inches by 20 inches, which gives an area of 450 square inches, or less than the combined area of the air inlets where there is no heat.

The charging door measures only 12 in. by 13 in., which seems very small to take the coke from a 14-foot retort with a section of 16 in. by 28 in. The producer goes right through the bed; and the clinkering is done at the back (see Sketch No. 5), where it will also be noticed that there is an auxiliary charging door on the top stage which can be fed with cold coke if it is found better to have a larger supply in the producer.

Over here, a feeling seems to prevail that one cannot have too

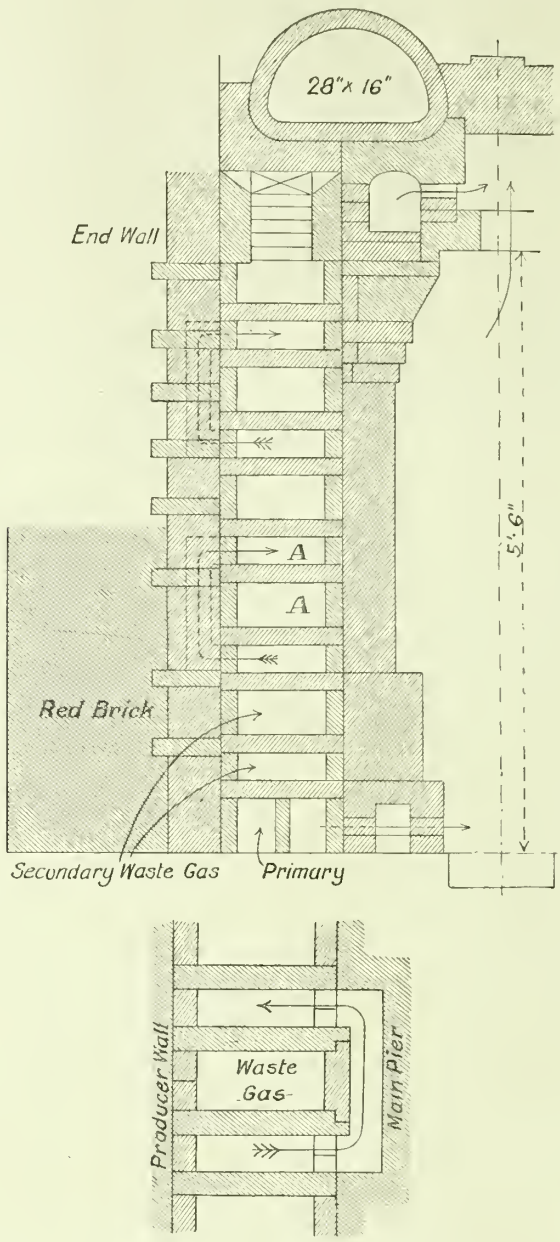


Fig. 4.—A Generator and Producer.

many sight-holes in a bench; and in each bed of these inclines there are 24 of them—14 above the regenerator, and 10 for inspecting the air and waste gas flues, besides 6 unprotected holes where dampers slide in (of which more anon).

Sketch No. 5 gives details of the producer in longitudinal section. From this it will be seen that the bed is one huge kiln with no cross dividing wall, and not even a longitudinal wall to separate the different halves of the regenerator. It remains to be seen how this will work out; but I feel sure that before the stack is completed, alterations will be made to admit of better separate

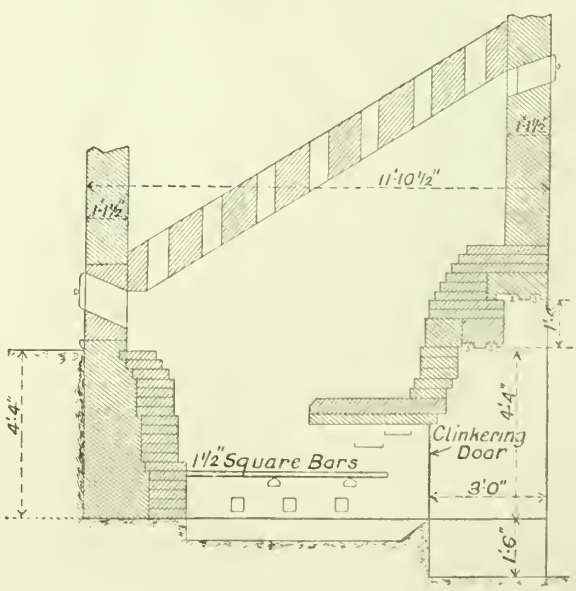


Fig. 5.—Longitudinal Section of the Producer.

control of the gases to each regenerator, and the provision of dampers to control the supply of gas from the producer to the top and bottom sections of the setting.

It is hardly necessary to call attention to the fact that all the gas-nostrils are one size; so there will be a difficulty in ensuring an even supply of heat to the different parts of the setting, owing to the greater pressure in the parts caused by different altitudes. It is suggested now that the holes might be made bigger, and various tiles or blocks be provided to drop into them—the holes in the blocks being larger or smaller as necessity may determine. It is hoped that the draught may be regulated by dampers, which are so set as to divert the pull from the top to a lower section, as shown on Sketch No. 6. But the plain is, I believe, quite a new departure, and only a trial can decide if it will be effective.

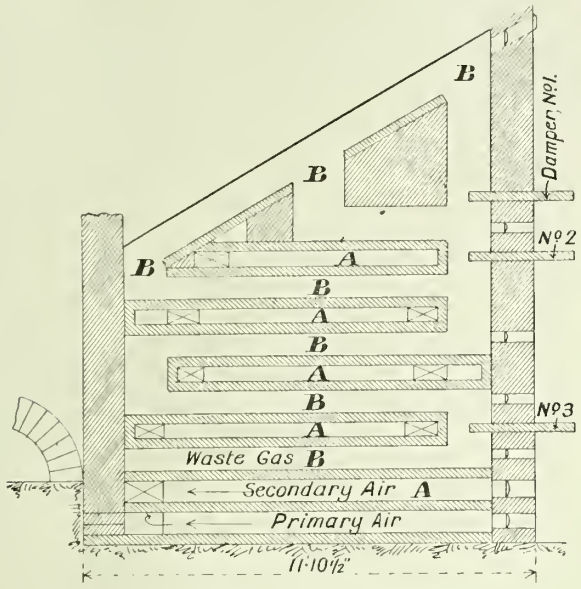


Fig. 6.—The Dampers of the Regenerator.

It will be noticed on the sketch that there are three dampers to each half of the regenerator; and the idea is that by closing No. 1, the gas will be induced to keep clear of the top end of the retorts if the heat is found to be too great there—the flow thus going in the main part to the mid outlet to the waste-gas flues. But if the centre section of retorts is found too highly heated, by partly closing damper No. 2 the major part of the gases will be diverted to the front of the setting. There is no chimney damper; so that damper No. 3 in the regenerator will be used to control the pull in the setting.

I may say that the retorts are supported by cross walls, six in number, built of special interlocking blocks. The width gives a bearing of 6 inches for the retorts; the space being 11 inches between the blocks. This is, I believe, a greater span than one would care to adopt in England.

In a subsequent article I propose to give some details of iron-work, mains, &c.

SULPHURIC ACID IN THE AIR OF TOWNS.

In the "JOURNAL" for the 4th of June, attention was called to a lecture delivered by Professor A. H. Church, F.R.S., at the Royal Institution, on the subject of "The Conservation of Historic Buildings and Frescoes," in the course of which he made some remarks on the injury caused by the presence of sulphuric acid in the air of large towns, and especially of London. The full text of the lecture has now been published, and we extract therefrom the portions dealing with this matter.

There is no doubt that the larger proportion of the sulphur present in coal escapes during burning in the forms of sulphuric and sulphurous acids. Some remains in the ash; and this quantity may be increased by mingling slaked lime with the coal. (Lime water, which has been suggested for this purpose, is far too weak; indeed, 3000 gallons, or 13 tons 8 cwt., would be required to fix the sulphur of 1 ton of coal.) But there is a minor, though by no means negligible, source of sulphuric acid in the products of the combustion of coal gas. Since the restrictions imposed on the London Gas Companies have been relaxed—that is, since Oct. 1, 1905—the sulphuric acid from this source has trebled in amount; the average during the twelve months preceding the relaxation having been 11½ grains per 100 cubic feet, but in the subsequent twelve months 33 grains. I have to thank Dr. Clowes, the Chief Chemist and Superintending Gas Examiner to the London County Council, for his kindness in supplying me with the official figures. And during the present year so far there have been 43 grains in the same volume of gas. The corrosion of copper boilers heated by gas is now so much more rapid that their lives are shortened in the ratio 7 : 2. If sulphuric acid from coal gas, like that from paraffin oil, contributes in a comparatively small degree to the pollution of the general atmosphere of London, it exerts a definitely injurious action when produced in close proximity to an easily affected surface, such as that of a fresco, within a building. No wonder that the delicate film of calcium carbonate, the distinctive binding material in a fresco, will soon perish under the onset of oil of vitriol.

Here let me anticipate what I might have relegated to a later part of my discourse—viz., a few words concerning the best known frescoes in the Palace of Westminster. I do this because the question of sulphur in gas happens to have been brought into close connection with these paintings in consequence of a parliamentary paper published last year. For it has been urged, by one who writes in the interest of the gas companies, that "the hydrochloric and nitric acid vapours resulting from the electric arc lamps in nightly use in London are even more pernicious than the burning of gas as at present manufactured." But it must be remembered that analyses of London air and London rain prove that the proportion of these acids present is quite insignificant compared with that of sulphuric acid. The same writer states that five frescoes in the King's Robing-Room in Westminster Palace have required nothing more than the removal of dirt. This remark is made in order to discount a statement of mine in the parliamentary paper just named. This statement runs thus: "The increased and increasing consumption of coal in London, and the greater licence allowed to the gas companies in the matter of freeing their gas from sulphur compounds, must result in a serious augmentation of sulphuric acid in the air of the Metropolis." But very much more than the removal of dirt was needed. The frescoes are no longer frescoes. While retaining the aspect of frescoes, they have been transformed gradually into paintings which have had their original binding material replaced mainly by ceresin and paraffin wax, unalterable compounds competent to resist even sulphuric acid. But not only has the painted surface required fresh protection, but the ground itself has had to be strengthened by similar treatment; the plaster having been in many places "sulphated" and thus rendered rotten.

And now I turn to another criticism of the already-quoted passage from the latest parliamentary paper on the Westminster frescoes. It will be found in the "JOURNAL OF GAS LIGHTING" for the 21st of August last. The writer, after stating that he is not then disposed to question the opinion that it is sulphuric acid which is the chief destructive agency at work on the Westminster paintings, argues that the greater licence allowed to the gas companies will result in an improvement of the London atmosphere. The line of argument is this: "The use of gas will be extended by the cheapening which the slight increase in the permitted amount of sulphur in the gas involves." In consequence less coal will be burnt; and there will, therefore, be less sulphuric acid produced and thrown into the atmosphere. For it is admitted on all sides that the burning of coal is the prime source of the sulphuric acid in the general atmosphere. Of course, if gas were made at or near collieries, and sent in pipes to the big cities, and displaced coal for heating as well as lighting purposes, we should go far to abolish town smoke, and should greatly lessen the sulphuric acid. Unfortunately for the actual cogency of this argument, we find that the three chief gas companies in the County of London have not reduced the price of their gas in the smallest degree since the relaxation of the rule about sulphur, while their gas has, during the twelve months ending Sept. 30, 1906, discharged into the air three times as much sulphuric acid—and during the last three months (January to March) four times—as it did under the former restrictions. This is, indeed, a retrograde movement.

Manchester District Institution Excursion.

The Sub-Committee to whom were entrusted the arrangements for the August excursion of the Manchester District Institution of Gas Engineers, are to be congratulated on the excellent preparations they made for the trip to Worksop and the Dukeries last Saturday. A long day full of interest was the result; the weather being fine, though not any too bright. On reaching Worksop, light luncheon was served at the Royal Hotel, after which the party drove to Welbeck Abbey, where the hour-and-a-half the programme allowed for the inspection of the house and grounds was all too short for the majority of those present. The drive was then continued to Ollerton; and here an excellently served luncheon awaited the arrival of the party at "The Hop Pole" Hotel—a well-known house which has recently undergone extensive development, and is now replete with every comfort for both occasional visitors and for those able to spend a longer time than was possible on Saturday among the beautiful surroundings of Sherwood Forest. The return journey to Worksop *viâ* Clumber and Thoresby was much enjoyed; and all were ready for the tea provided at the Royal Hotel, Worksop. In the course of the day, opportunity was taken to formally thank the Sub-Committee—Messrs. J. H. Brearley, J. Wilkinson, G. H. Niven, and the Hon. Secretary of the Association (Mr. H. Kendrick)—for their trouble in arranging the day's programme. Needless to say, the President of the Association (Mr. William Prince, of Stoke-on-Trent) busied himself throughout the day in looking after the welfare and enjoyment of the party, which included, as is usual on these excursion meetings, a considerable number of lady friends of the members.

ANALYSIS OF PRODUCER GAS FOR THE POWER ENGINEER.

The current number of the "Chemical News" contains an article on the above subject by Mr. H. Procter Smith, F.C.S.

In the writer's opinion, there is nearly always a gap between the results given by a chemist and the data required by an engineer to act upon the information given. As a rule, this gap can be filled much more easily by the chemist than by the engineer; and if it were filled by the mutual co-operation of the chemist and the engineer, there is no doubt that valuable information would be acquired, and would eventually bring the chemist and the engineer to be recognized as main factors in helping to swell the profits of an industrial concern, and not as at present mere non-producers and a necessary nuisance.

This is illustrated in a very striking manner since the rapid advances which have been made in utilizing producer gas as a motive power in a gas-engine. In this instance, we have a chemist who makes analyses of samples of the gas, and perhaps offers suggestions as to the reason for an increased percentage of carbon dioxide, or of hydrogen, and so forth, and who reports to the engineer the relative quantities of carbon dioxide, carbon monoxide, hydrogen, marsh gas, &c. But, as a rule, this is all.

Now, the engineer knows that he wants a gas with as large an amount of combustible as possible, and he also knows that the gases carbon monoxide, hydrogen, and marsh gas are combustible. But from looking at the mere percentages of these gases he cannot, as a rule, form much idea of the amount of horse power which this gas will develop in his engine; and the factors given below are such as will enable the engineer or the chemist to rapidly convert the gas analysis into a heat analysis, and from that to a power analysis.

The power capable of being developed by a gas is a ratio of its heating value; and this value is in relation to the amounts of its constituent gases. An element when combining with oxygen evolves a certain definite amount of heat, and (if this change is brought about rapidly) also light, when the process is termed "combustion." With the commoner elements—carbon and hydrogen—use is made of this reaction to generate heat; and the elements are termed fuels. Coal is a mineral consisting chiefly of carbon and hydrogen, and may be ignited and burnt in air with the generation of heat. Coal may also be partially burnt in a closed vessel (termed a gas-producer), and converted into gas which may be burnt and converted into power apart from the vessel in which the gas is generated.

The amount of heat so generated is expressed in two chief units: The British thermal unit (B.Th.U.), which is the amount of heat required to raise 1 lb. of water 1° Fahr.; and the kilogramme-calorie, which is the amount of heat required to raise 1 kilogramme of water 1° C.—the water in each case being at its point of maximum density, 39·2° Fahr. or 4° C.

The heating or calorific value of carbon is 14,544 B.Th.U.; that is to say, if 1 lb. of carbon were burnt in oxygen or air, it would generate enough heat to raise 14,544 lbs. of water 1° Fahr.

To consider now the combustible gases. Carbon monoxide has 4386 B.Th.U. per pound; hydrogen, 61,524 B.Th.U.; marsh gas, 24,021 B.Th.U. This is the heat generated from these gases in parts by weight. But, as we generally measure gas, these figures require to be converted into the B.Th.U. or calories which are developed by burning 1 cubic foot or 1 cubic metre of the gas.

Further, in burning all substances containing hydrogen, the combustion produces water; and if, as is generally the case, the final temperature is above 212° Fahr., this water is converted into vapour (steam), and passes off in the waste gases. Now, the conversion of water at 212° Fahr. into steam at 212° Fahr. absorbs a large amount of latent heat, which can only be recovered by condensing the steam. Thus the available calorific value produced by burning hydrogen is lowered; and therefore in all compounds containing hydrogen we have a total and an available calorific value.

The following factors serve to convert hydrogen, carbon monoxide, or marsh gas directly into either B.Th.U. or calories:—

	B.Th.U. per Cubic Foot.		Kilo.-Calories per Cubic Metre.	
	Total.	Available.	Total.	Available.
Carbon monoxide	3·419	3·419	30·43	30·430
Hydrogen	3·473	2·924	30·91	26·026
Marsh gas	11·278	10·133	100·38	90·225

To convert calories per cubic metre into B.Th.U. per cubic foot, multiply by 0·11235; to convert B.Th.U. into calories, multiply by 0·252; to convert calories to B.Th.U., multiply by 3·968. To show how such a calculation may be worked, suppose we have a sample of Mond gas of the following composition:—

	Per Cent.	B.Th.U. per Cubic Foot.	
		Total.	Actual.
Carbon dioxide	12·9	Nil.	Nil.
Carbon monoxide	13·2 × 3·419	45·14	45·14
Hydrogen	24·8 × 3·473 or 2·924	86·13	72·51
Marsh gas	2·3 × 11·278 or 10·133	25·94	23·30
Nitrogen	46·8	Nil.	Nil.
	100·0	157·21	140·95

Thus, by a few very simple calculations it is possible to convert a chemical analysis into a heat analysis.

Then, for power conversion, 1 B.Th.U. = 778 foot-pounds, and 1 H.P. = 33,000 foot-pounds. Thus the theoretical power analysis is merely a matter of proportion.

It must, however, be borne in mind that the theoretical and practical results seldom exceed 25 per cent.; but to the gas-power engineer the calorific power, rather than the chemical analysis of a gas, is what is required.

Utilization of Towns' Refuse for Gas-Making.

The growth of large cities during recent years has rendered more difficult of solution the problem of the disposal of the continually increasing mass of refuse. The only means at present available are tipping the stuff on waste land and leaving it to rot, taking it on barges or by rail to some distant spot or far out to sea, or burning it in a destructor. The last, though undoubtedly the best system, leaves much to be desired, both from a sanitary and a financial point of view. Another method of disposing of refuse has been discovered which, it is claimed, gives much more surplus heat than the destructor, and not only furnishes it in its most convenient form—viz., gas—but also yields valuable residual products in the shape of ammonia, &c. The method referred to is that of the Refuse Converter Company, Limited, of 5, Robert Street, Adelphi, for whom a trial extending over ten hours was carried out at the Barking Gas-Works in May last by Mr. H. A. Humphrey, M.Inst.C.E. We have received a copy of his report, but, for the present, its contents must be regarded as confidential. This, however, may be stated, that Mr. Humphrey considers the system, as applied to existing gas-works of which it is desired to increase the output, has a distinct field of usefulness. The profit arising from working it is reckoned at from 2s. 4d. to 3s. per ton of refuse dealt with, exclusive of the amount obtainable from the local authority for its disposal.

We are asked by the Manager of the Manchester Gas Exhibition (Mr. Walter Cawood) to remind our readers that it will be held from Oct. 23 to Nov. 9. As already intimated, the exhibits will comprise appliances for interior and street lighting; cooking, heating, and ventilation for public and domestic purposes; motive power for industrial uses; and various applications of gas in textile and other factories. Residual products and models of gas plants, with testing apparatus, will be well represented. The Joint Advisory Committee consists of members of the Manchester District Institution and the members of the Society of British Gas Industries; Mr. Thomas Newbigging being the Chairman, and Messrs. H. Kendrick (Stretford) and W. Whatmough (Heywood) the Hon. Secretaries.

By a recent decree of the President of the French Republic, M. Alfred Lebon, General Manager of the Compagnie Centrale d'Eclairage par le Gaz, has been nominated a Chevalier of the Legion of Honour.

We are informed that the Nichtigkeits Abtheilung of the German Patent Office has annulled the Dellwik water gas patent No. 105,511. The case will, in due course, be definitely settled by the Reichsgericht.

Sir Alexander B. W. Kennedy, the President of the Institution of Civil Engineers, will perform the opening ceremony in connection with the forthcoming Engineering and Machinery Exhibition at Olympia, on Thursday, the 19th inst. He will be supported by Sir William H. White, last year's President, and a number of other leading men in the scientific world.

The death occurred on the 25th ult., in his 88th year, of Mr. Thomas Bugden, who for upwards of half-a-century had carried on business as an india-rubber manufacturer in the Goswell Road, and was one of the best-known men in the trade. The event calls for notice in our columns from the fact that deceased was the original maker of gas-bags for use in repairing mains, and was consequently in close touch with the distribution of gas. The funeral took place at the Islington Cemetery, Finchley, last Thursday, and was largely attended.

We learn that, in view of the coming season, the "Star" Inverted Incandescent Burner Company, Limited, have improved their burner by altering the shape of the renewable porcelain nozzle, which is now so designed that, as the tip becomes worn by the heat, the light of the mantle increases, whereas in the older form deterioration was attended by a slightly diminished illumination. An alteration has been made in the mantle-carrier, with the view of minimizing deposits; and the air-tubes—a patented feature of the burner—are now controlled by shutters at two inlets instead of only one as formerly. In conjunction with these improvements, a somewhat heavier metal is being used this year for the burner, with which an improved non-sticking bye-pass nipple, with lever and chains, or a single lever with an insulating knob, can be supplied. The Company have also effected improvements in their mantles to increase their durability.

ILLUMINATION PHOTOMETERS AND THEIR USE.

By Preston S. Millar.

[A Paper read before the Illuminating Engineering Society at their Boston Meeting.]

In this discussion, instruments which measure the chemical or calorific effects of lights are not considered. The illuminating engineer is concerned more particularly with instruments designed to aid the eye in determining the illuminating effect of light. These may be classified broadly as photometers dependent upon visual acuity, and those in which the illumination to be studied is compared to that produced by a standard light source.

Visual Acuity Photometers.—The principle of visual acuity, as generally applied, depends upon the detection of the vanishing-poiut of an effect produced by the light to be studied. In some cases it is the disappearance of a figure or character; in others, the disappearance of a contrast. Such instruments, being based on the ability of the eye to see or distinguish objects, yield results which are proportional more nearly to those qualities of light which make for visibility than to its intensity. They are known as visual acuity photometers, or illuminometers. There are fundamental difficulties with this extinction method which render it unsuitable for important work. These are: The inability of the eye to judge with precision of the point of disappearance; the susceptibility of the eye to the influence of environments and conditions; the necessity for reducing the light to low intensities at which the "Purkinje effect" operates to distort results; and the errors encountered in effecting this reduction. The decided advantages which this method can boast are simplicity, absence of expensive adjuncts, and a minimum demand for technical knowledge and skill on the part of observers.

Illumination Photometers.—The only photometers which may be relied upon in engineering work to yield reliable values are those in which a comparison light source is used, and reliance is placed upon the ability of the eye to judge equality of illumination. The essential features of such photometers are: (1) A photometric device; (2) a comparison light source; (3) a means of varying the intensity of the illumination produced on the photometric device by the comparison light source; (4) a test-plate on which the unknown light falls.

Photometric Devices.—These may be divided into three groups: (1) Arraugements of prisms whereby surfaces illuminated by the comparison and the test light sources may be viewed in one field with an indistinguishable line of separation. Such devices are characterized by maximum sensibility and ease of comparison, but are generally difficult and expensive of construction. Particularly with low intensities they are superior, working with fair sensibility on intensities quite below the range of other devices. The Lummer-Brodhun photometer is a notable example of devices of this kind. (2) Screens of varying translucency; the opposite sides being illuminated by the comparison and test sources respectively, and being viewed through prisms or mirrors in contiguous fields. The Bunseu photometer is the well-known example of this class of photometric devices. Various adaptations of the Bunsen photometer are used very largely in photometric work in America. In general, they fall but little short of the prismatic devices of the first class in respect to sensibility and ease of comparison, and are simple and inexpensive of construction. (3) The various devices whereby the illumination intensities produced by the comparison and test-light sources respectively are viewed in contiguous fields with a well-marked line of separation. In this class may be found the Bouguer screen, the Ritchie wedge, the translucent blocks of Elster and Joly, and other means of comparing illuminatiou intensities, all of which are simple and inexpensive of construction, but lack in sensibility aud ease of comparison.

Other photometric devices will be found described in text-books on photometry; but they do not merit serious consideration at this time—in most instances failing to equal those described in point of accuracy, reliability, or simplicity. Of these, the flicker photometer is noteworthy. The difficulty in manipulating it, and its inapplicability to electric lighting by alternating current, make it unsuitable for use in illumination photometers.

Comparison Light Sources.—These are found in great variety in photometrical work. They may be classified broadly as flame sources and incandescent electric lamps. Among the flame sources, two deserve special mention. The pentane lamp—the legal standard of light in Great Britain—is used largely by gas companies in laboratory practice as a primary standard of light. The Hefner amyl-acetate lamp, the legal standard of light in Germany, is used largely there as a primary standard of light, and somewhat in America in both laboratory and portable photometers. In addition, kerosene, benzine, and gas-burners have been used in photometers as secondary standards of light.

The pentane and Hefner lamps as primary light standards give results of considerable precision when used in the laboratory, under carefully controlled conditions, and manipulated by those who are expert in their use. In common with the other flame sources used as secondary standards in portable photometers, but little in the way of precision and reliability can be expected. They are all so dependent upon uniform conditions of burning as to be unreliable when used where they are moved about the room, or where they are liable to changes in atmospheric conditions and in draughts. The fire risk which they entail is a strong objection to their use. The only place which they should have in the measurement of illumination is in connection with photometric apparatus which lays no claim to high precision, and in which simplicity of construction, absence of measuring instruments, and source of energy supply, constitute an advantage which overbalances the superior accuracy obtainable with the incandescent electric lamp properly used. Such a field flame sources undoubtedly fill—offering a means of determination much superior to that obtainable with photometers based upon the visual acuity method.

With the incandescent lamp used as a secondary standard of candle power, most favourable photometric conditions may be obtained. Its use, however, necessitates a source of current supply and a means of determining with fair precision the voltage at which it burns or the current it consumes. Under these conditions, it may be relied upon to remain constant for a limited period, during which time it constitutes the most reliable, accurate, and satisfactory comparison light source.

Means of Varying the Intensity of Illumination Produced upon the Photometric Device by the Comparison Light Source.—This has been accomplished by a variety of methods, some of considerable ingenuity. These may be classified as follows: (1) Variation in distance, applying the inverse-square law; (2) rotating discs, relying upon Talbot's law; (3) inclination of an illumiuated surface, applying Lambert's law of the cosine; (4) variation of the intensity of the comparison light source; (5) the use of absorbing media; (6) the use of variable diaphragms, generally with diffusing screens; (7) dispersion lenses; (8) polarization method. Of these, the variable distance method is, in the opinion of the writer, superior, in that it possesses accuracy, reliability, ease of verification, calibration according to a known law, simplicity, a wide range, and universal applicability. No other one method possesses all these advantages.

The properties of the rotating sectored disc have been investigated on a number of occasions, perhaps most recently by Dr. E. P. Hyde.* This is an excellent means of varying the intensity of light, but lacks somewhat in simplicity where it alone is relied upon. It is possible that, under some conditions, errors might be introduced by this method wheu applied to alternating current electric lighting, and to some other forms of lighting in which periodical flickering phenomena are encountered.

The variation of the inclination of a plane with reference to the light incident upon it, or to the augle at which it is viewed, is an unsatisfactory method—first, because unless a perfect diffusing surface is obtained, the cosine law will not apply, and the instrument should be calibrated empirically; secondly, because any surface which approximates a perfect diffusing surface is likely to change in character, which would introduce an error into the scale calibration of the instrument; aud, thirdly, because the scale calibration of an instrumeut in which this is used becomes very narrow with low intensities, so that the slightest displacement of the plane will produce a marked difference in the illumination in the region where the photometric comparison is rendered difficult because of the low iutensity which is being studied.

Two methods of varying the intensity of the comparison light source have been used. In one, adjustable opaque screens expose a greater or less portion of the luminous body—a method particularly applicable when flame comparison sources are used. The other method consists in varying the intensity of the source itself—with flame sources, by some wick adjustment; and with electric lamps, by varying the curreut flow. This method is unsuitable for use with flame sources, because it is uecessary to wait some time after an adjustment is made before a constaut luminous intensity is obtained. With electric lamps it is objectionable, because the satisfactory range throughout which the method may be applied is of necessity small, since with very low intensities the colour value becomes altogether objectionable, and with higher intensities the lamp must be operated at so high an efficiency as to endanger its constancy.

Absorbing media offer an excellent and very practicable meaus of varying the light intensity; but they must be selected carefully in order to guard against errors due to selective absorption. Properly selected, they form au excellent adjunct to a photometric system. If, however, they have any marked tendency towards selective absorption, they must be used very intelligently, or errors will be introduced. While it is possible to construct absorbing screens which may constitute a complete device for varying the intensity, this method has found its best application in varying the intensity by large steps where supplementary means are provided for effecting finer variations. The comments in this paragraph apply as well to the use of absorbing screens with variable diaphragms.

Dispersion and polarization methods are but little used in America in photometry of the class now under discussion. The writer has had no experience with these methods; but since obviously superior and more practicable means are available, they would seem to merit but little consideration.

The Test-Plate.—In general work, the intensity of the light incident upon a given surface is the only quantity which it is practicable or even desirable to measure. This is not proportional necessarily to the illuminating effect, which varies as well with the point from which the surface is viewed, with the colour of the light, and with the colour and character of the surface. The

* An interesting paper, read before the Illuminating Engineering Society by Dr. Hyde, was given last week (p. 576).—Ed. J. G. L.

criterion by which the light intensity is judged must be strictly proportional to the light incident upon the test-plate, and must be independent of each of the other improper variables just mentioned, if the results of the observation are to show the intensity of the light incident upon the surface.

Whether or not the light falling upon the photometric device varies only with that incident upon the test-plate depends upon the design and location of the plate. Consequently there is no feature of an illumination photometer more deserving of the attention of its designer. But, strange to say, in this particular many instruments are badly designed and liable to large error.

The requirements for a theoretically correct test-plate are: (1) A plane white surface which, when viewed from the point of photometric observation, obeys Lambert's law of the cosines with reference to intensity of illumination produced by light incident upon its surface at any inclination and from any direction; (2) a material which will not introduce errors due to colour differences; (3) a plate which may be placed at any angle; (4) a location such that neither the body of the observer nor parts of the instrument shall obstruct light falling on the plate.

The character of the surface upon which the effect is studied naturally influences the results materially. If it were to consist of a mirror in which practically all the reflection is regular, the value assigned to any light incident upon its surface would vary from *nil* to 100 per cent., depending upon whether it was viewed from a point within or outside the field of regular reflection. If the surface were glazed, light incident upon it at angles of sharp inclination would suffer or profit unduly through regular reflection; the nature of the effect depending upon the point from which the surface is viewed. Hence it is necessary to secure a plane surface which shall be as nearly as possible a perfect diffuser of light, in order that light incident upon it at any angle may be credited with its true intensity, and only its true intensity. Unfortunately, there is no available surface which accurately meets these requirements. Therefore, in selecting a surface, the requirements must be kept in view as an ideal, and must be approximated as closely as may be practicable.

Until it shall be found possible to use a true diffusing surface, results must vary with the direction from which the test-plate is viewed, unless it is studied by reflected light from a point directly above the centre of the plate, or by transmitted light from a point directly beneath the centre. The first is obviously impossible, because it would necessitate interference with light which would otherwise fall upon the test-plate. It follows, therefore, that the correct method is to consider transmitted light from a point directly beneath the plate.

It is, of course, desirable to measure all the light which would be incident upon an object at the point to be considered. In all interior lighting systems there is more or less diffused light, all of which has some illuminating value. In order to measure all the effective light, there must be no objective interference with light incident upon the plate at any angle. This means that all parts of the instrument, as well as the observer, must be beneath or behind the surface of the test-plate. This is possible only when transmitted light, instead of reflected light, is measured.

The illuminating effect of any lighting installation may be a function of the horizontal, vertical, or normal illumination produced; while a study of the illumination produced upon surfaces otherwise inclined affords data of value and interest to any investigation. The necessity for providing simple means for placing the test-plate at any desired angle is therefore apparent.

The introduction of differences in colour values complicates photometry seriously. If the light from the mercury vapour lamp were to be studied upon a red surface, its illuminating effect would be no criterion of the light intensity. Hence the only colour which is practicable is white, of as great purity as may be obtainable, and as free as possible from selective absorption. With such a test-plate, lights of different colours are credited with approximately their true intensities, when the test-plate is viewed from the photometric device.

The Ideal Photometer.—It appears, therefore, that in constructing a photometer the designer has a choice of many photometric devices, comparison light sources, and means of varying the light intensity and effecting the photometric comparison. With respect to the test-plate there should be no choice. It should have a plane white diffusing surface; it should be translucent, and viewed from directly beneath its centre it should be capable of location at any angle; and it should be so located that all parts of the instrument and also the observer are beneath or behind it.

In the ideal photometer, such a test-plate would be found combined with the most sensitive photometric device, the most reliable comparison light source, and the best means of varying the intensity. These features should receive first consideration, for reasonable precision ought to be the first *desideratum*. Next in importance come portability, simplicity of operation, and reasonable cost.

As there is an insistent demand for an illumination photometer which shall be both reasonably accurate and thoroughly practicable, it is felt that a discussion of the instruments which have been designed with this in view will be of interest to members of the Society. In the following paragraphs will be found brief illustrated descriptions of eleven photometers; but only the essential features of each are touched upon. The diagrams are all lettered similarly, in order to facilitate comparison. Thus A indicates the test-plate, B the photometric device, C the comparison lamp, and D the means of varying the intensity.

Beckstein Illumination Photometer.—Fig. 1 is a plan of the photometer. The test-plate A is placed at the point where it is desired to study the illumination. This plate may be rotated throughout a vertical plane about the photometric device as an axis. B is a Lummer-Brodhun cube, through which the lower surface of the test-plate is viewed from H. Through the prisms may be viewed

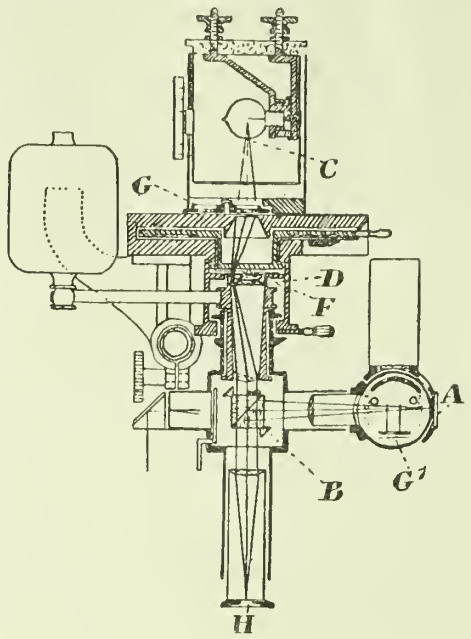


Fig. 1.—Beckstein's Photometer (Sector Type).

also the translucent plate G, which is illuminated by the comparison lamp C. Equality of illumination is obtained by viewing the plate through a portion of the lenses F which may be rotated. At the position D is placed a variable sector disc, about the axis of which the beam of light is rotated by the lenses. The result of the photometric setting is obtained from the size of the opening of the sector disc D, which is necessary in order to obtain equality of illumination. This device is a rotating sector disc, except that the beam of light instead of the sector is rotated.

Beckstein (Weber) Illumination Photometer.—This photometer, of which fig. 2 is a plan, is a modification of the Weber photometer, and is simpler in construction and less costly than the instrument described in the preceding paragraph. The test-plate and prism arrangement are similar; but the comparison lamp C is a benzene lamp, and equality of illumination is obtained by

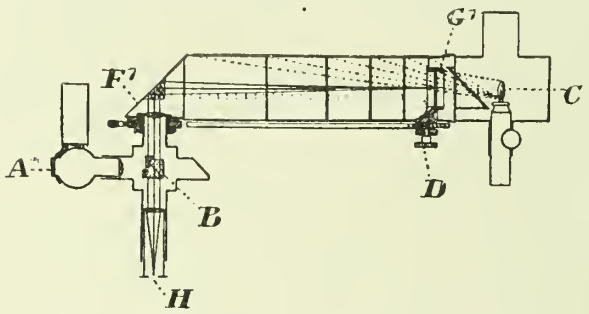


Fig. 2.—Beckstein's Form of Weber Photometer.

movement of the translucent screen G, by means of the rack-and-pinion device D, along a tube; its intensity of illumination varying as the square of the distance from the lamp. The results of the photometric settings are read off directly from a scale along the tube through which the plate G' travels.

Blondel and Broca's Illumination Photometer.—Fig. 3 is a plan of this photometer. The portion of the light which is transmitted

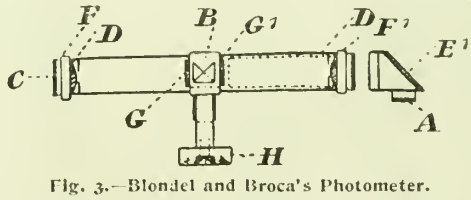


Fig. 3.—Blondel and Broca's Photometer.

through the test-plate A is reflected from the 45° mirror E' through the lens F' upon the ground-glass plate G' (which forms part of the photometric device). Before the lens F' is placed the "cat's-eye" diaphragm D'. A comparison light source C, which is not described, is placed to the left of the apparatus. Its light passes through the lens F, and falls on the ground glass G. This is varied in intensity by the adjustable "cat's-eye" diaphragm D. The photometric device B consists of crossed prisms through which the ground-glass plates G and G' are viewed from the binocular arrangement H. Equality of illumination is produced by

adjustment of the variable diaphragms D and D′, which are equipped with means for indicating the size of the aperture.

Burnett Illuminating Power Photometer.—A vertical section of this photometer is shown in fig. 4. The light to be studied falls on the test-plate A, which is one surface of a photometric wedge. The other surface is illuminated by the lamp C, which travels along the horizontal axis of the box. This lamp is moved by means of a handle D, which protrudes through the side of the box.

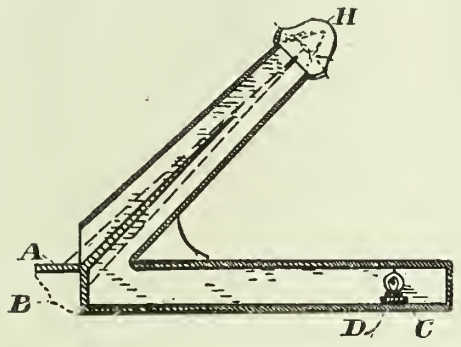


Fig. 4.—Burnett's Photometer.

The two surfaces of the wedge which constitutes the photometric device B are viewed from position H through a box divided by a partition which constitutes a well-defined line of separation between the two surfaces of the wedge. The results are indicated on a scale along the horizontal box, which is calibrated directly in foot-candles.

Marshall's "Luminometer."—The arrangement of this instrument is shown in fig. 5. The test-plate A is also the upper surface of the photometric device B. This consists of a screen of which the translucency is varied by different thicknesses of paper. It is illuminated from beneath by the comparison electric lamp C, the intensity of the light of which is varied by means of the rheostat D. The lamp C is operated from two dry cells within the instrument—a spring switch being placed in the circuit, so that the lamp is operated for a minimum time only. To effect a photometric setting, the flow of current through the lamp C is varied

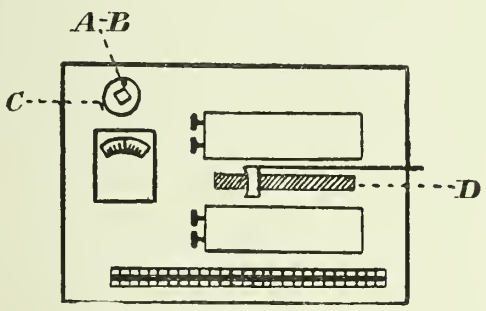


Fig. 5.—Marshall's Photometer.

until disappearance of contrast is obtained at the screen B when viewed from above at an angle of about 45° to its surface. The resistance of the lamp is then measured by means of a simple Wheatstone bridge with a portable galvanometer, both enclosed within the instrument. One arm of this bridge consists of an exposed wire, stretched taut. Beneath this wire is placed a millimetre scale. The contact is moved along the exposed wire until the point of no deflection is obtained, and the foot-candles value is then obtained from the scale reading through an interpretation curve.

Martens' Illumination Photometer.—Fig. 6 shows a vertical

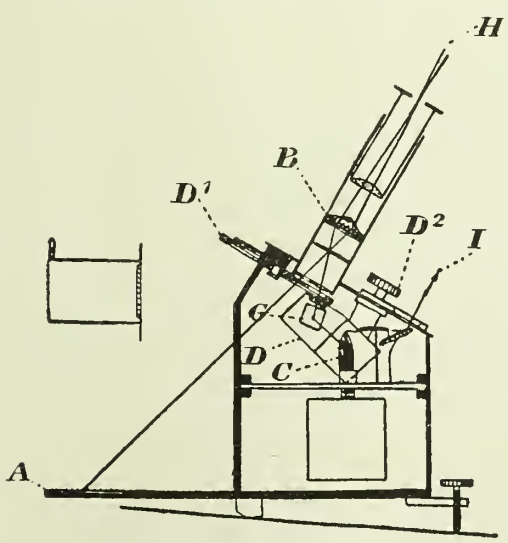


Fig. 6.—Marten's Photometer.

section through the instrument. The test-plate A, which receives the light to be studied, is observed through the photometric device B, through which may be seen also the surface of the plate G, which is illuminated by the comparison benzene lamp C through a pair of sliding mirrors D. These vary the distance between the lamp and the plate; being operated from the rack-and-pinion device D^2. The results are read directly from a scale over which plays a pointer attached to D^2.

Modified Design of the Mascart Photometer.—In fig. 7 the light to be studied falls upon translucent paper A, which constitutes

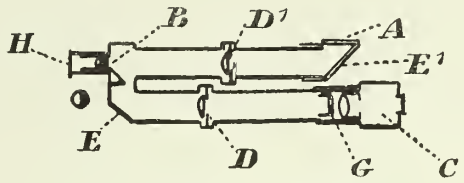


Fig. 7.—Mascart's Photometer.

the test-plate. That which is transmitted passes through the 45° mirror E′, a convex lens, and falls upon the upper half of the translucent screen B. A comparison lamp C illuminates the translucent screen G. Light which is transmitted through this screen passes through a convex lens, the 45° mirror E, the total reflecting prism immediately above E, and falls upon the lower part of the screen B, where it is viewed from H. Both lenses mentioned have adjustable diaphragms D and D′, which are used to vary the intensity and effect equality of illumination upon the screen. The adjustment of these diaphragms indicates the result of the photometric settings. The lamp C is a flat-flame gasoline one. The instrument is standardized by a Carcel lamp, the light of which falls upon the test-plate.

Preece and Trotter's Photometer.—Fig. 8 is a vertical section through this instrument. The light to be studied falls upon the

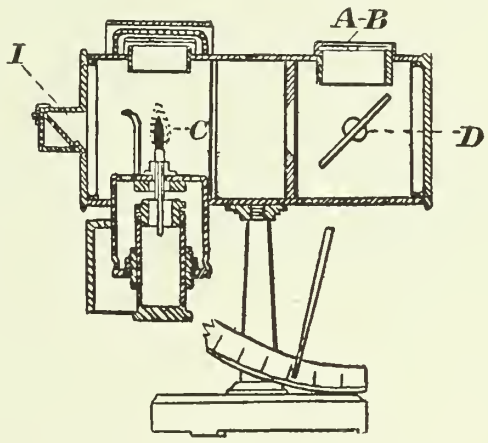


Fig. 8.—Preece and Trotter's Photometer.

surface A, which is also a portion of the photometric device B. The comparison lamp C illuminates a Bristol board D, which may be inclined at any desired angle. Through slits in the surface, portions of the screen D may be viewed. The photometric balance is made by equalizing the brightness of the surfaces A and D.

Ryan's "Candle-Foot" Photometer.—In fig. 9, which shows the instrument designed by Mr. W. D'A. Ryan, the light to be studied

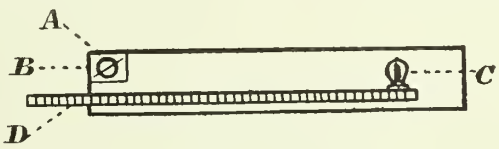


Fig. 9.—Ryan's Photometer.

falls at A upon one surface of the photometric device B, which consists of a translucent block divided diagonally by a thin opaque film. The comparison electric lamp C illuminates the other half of the block. The distance between this lamp and the block is varied by means of a rod D, on which is calibrated a scale indicating the results of photometric settings. The device B is viewed through the side; equal portions of the two halves of the block being viewed.

The Weber Photometer.—In this photometer, which is shown in fig. 10, the light to be studied is received upon the portable test-plate A, which consists of white cardboard. This is viewed from the eye-piece H through a simple Lummer-Brodhun cube B. The light from the comparison benzene lamp C illuminates a travelling translucent screen G, which is viewed from the eye-piece H through B. A unique feature is the use of coloured glasses in the ocular tube with a view to comparing illuminants of different colour values with respect to those qualities upon which depends the ability of the eye to perceive objects which they illuminate. As

has been stated, this is not necessarily proportional to the intensity of illumination.

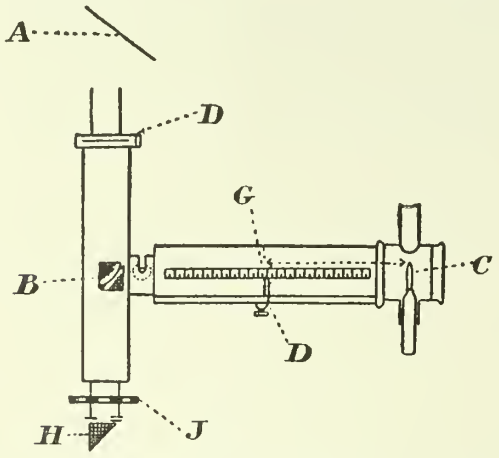


Fig. 10.—Weber's Photometer.

The Weber photometer is now made in a more portable form, and with some modifications. Fig. 11 is a vertical section of this instrument. The test-plate A bears a fixed relation to the photometric device B; but it may be placed at any angle in a vertical

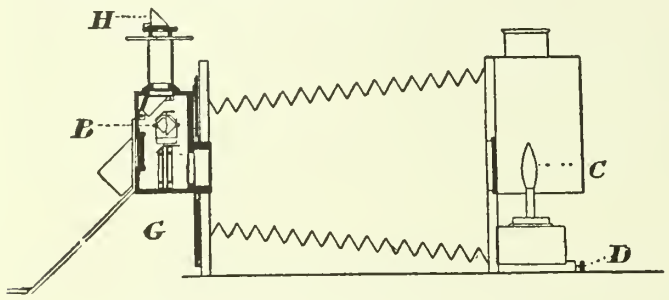


Fig. 11.—Portable Form of Weber Photometer.

plane—the photometric device moving with it around the horizontal axis of the comparison Hefner lamp. Equality of illumination is obtained by moving the lamp C along the photometric axis. Results appear in terms of a unit of illumination intensity. The range is increased by means of absorbing screens.

The accompanying table shows the character of the essential features of each of the photometers described:—

Photometer.	Photometric Device.	Comparison Source.	Variable by which Setting is Made.	Test-Plate. May be Placed.	Test-Plate. Colour.	Test-Plate. View Point.	Test-Plate. Location with Reference to Instrument Parts.	Method of Use.
Beckstein—								
Sector type	High sensibility.	Electric lamp.	Sectored disc.	At any angle.	White.	Correct.	Correct.	Not stated.
Weber type	High sensibility.	Benzene lamp.	Distance.	,, ,,	,,	,,	,,	,,
Blondel-Broca		Not described.	Diaphragms.	,, ,,	,,	,,	,,	
Burnett	Low ,,	Electric lamp.	Distance.	,, ,,	,,	Incorrect.	Incorrect.	Substitution.
Marshall	Low ,,	,, ,,	Current.	Horizontally.	Pinkish white.	,,	Correct.	Direct comparison.
Martens	High ,,	Benzene lamp.	Distance.	,,	White.	,,	Incorrect.	
Mascart (modified)		Not described.	Diaphragms.	At any angle.	,,	Correct.	Correct.	Substitution.
Preece-Trotter	Low ,,	Amyl-acetate lamp.	Inclined surface.	Horizontally.	,,	Incorrect.	,,	
Ryan	Low ,,	Electric lamp.	Distance.	Horizontally or vertically.	,,	,,	,,	
Weber	High ,,	Benzene lamp.	,,	At any angle.	,,	,,	Incorrect.	
Weber (portable)	High ,,	Amyl-acetate lamp.	,,	,, ,,	,,	,,	,,	Direct comparison.

A study of this table will show that no one of the instruments conforms in all particulars to the requirements for an illumination photometer. For example, the Martens photometer incorporates many good features; but its designer has largely destroyed its usefulness by giving the test-plate an impossible location where the measurement of the total illumination produced in any diffused lighting system is entirely out of the question, because the instrument itself obstructs so much of the light.

It was hoped a number of the instruments could be obtained for investigation, but some of them are more or less in the experimental stage, and their designers were not in a position to offer them for this purpose. However, two of the instruments were tested. The results obtained illustrate the extent of errors which may be encountered in measuring illumination with instruments which are incorrectly designed. As respects the sensibility of the photometric device, it was found from repeated settings with one of the instruments in which the device is of low sensibility, that no higher accuracy than 6 per cent. could be obtained. The maximum variations in settings with this instrument were 15 per cent. below and 10 per cent. above the average. It was found that in one of the instruments in which a flame source was used, readings could not be relied upon within 5 per cent. because of flame variations due to draughts, changes in humidity, &c.

In measuring diffuse illumination, where much of the light comes from the ceiling and walls, it was found that with two of the instruments in which the design and location of the test-plate were incorrect, results were obtained which were too low by 20 and 29 per cent. respectively. This was due to regular reflection and obstruction of light by the body of the observer or by parts of the instrument. With the same instruments, change from a black coat to a light coat on the observer introduced differences amounting to 10 and 18 per cent. The extent of these errors illustrates the necessity for careful design and location of the test-plate. It is hardly worth while making a photometer which is liable to errors of this character, in addition to any others which may be entailed by the use of improper comparison light sources, low-sensibility photometric arrangements, and errors in varying the intensity of the light from the comparison light sources.*

As an illustration of the possibilities of errors entailed by reliance upon the direct-comparison method in which a standard lamp is used directly in comparison with the test source, it was found that with one of the instruments seven skilled observers (who, however, were not familiar with the particular instrument under test) obtained values which varied from 21 per cent. below to 34 per cent. above the value which was considered to be representative —viz., the mean result of the seven observers. The average variations of these observers from such mean was 13 per cent.

While it is unlikely that there should be incorporated in any one instrument all the bad features referred to, yet all the photometers mentioned fail to meet theoretical requirements in one or more particulars. The errors found in some of the models are, therefore, shown in the following table for reference:—

	Per Cent.
Photometric device of low sensibility	6 to 10
Flame source as comparison lamp	3 ,, 5
Direct-comparison method, neglecting personal equation	13 ,, 34
Improper design and location of test-plate when measuring diffuse illumination	20 ,, 39

Use of Illumination Photometers.—In the measurement of illumination, either of two general methods may be followed. The first is the direct-comparison method, in which a primary standard of light is employed, or a secondary standard of light is used as a primary standard, so far as the instrument is concerned. The Hefner lamp more than any other light source is used in this way. Or an incandescent electric lamp may be standardized to yield a certain candle power, and may be used, as is the Hefner lamp, for direct-comparison purposes. Such a light source is located at a definite distance from the photometric device, and is calculated to produce a fixed intensity upon that device. This method has the great advantage that it permits an instrument to be more nearly self-contained, and to be used without reference to any other light sources. However, it is liable to serious objections in that all changes in reflecting surfaces or transmitting screens or changes in the comparison lamp, as well as any misplacements of parts, are likely to introduce errors for which no compensation is made. Furthermore, the method makes no allowance for the personal equation. The second, and superior, method is commonly known as the substitution method. This covers a multitude of photometric sins. Here the comparison light is strictly secondary, and is standardized and verified from time to time by other standards of light so placed as to produce upon the test-plate illumination of known intensity. By this method, changes which would introduce errors where the direct-comparison method is used are compensated for entirely or in part, since every effect which they produce upon the

* Generally speaking, European instruments, as illustrated in the Beckstein, Blondel and Broca, Martens, Mascart, Preece-Trotter, and Weber photometers differ from American instruments as designed by Burnett, Marshall, and Ryan, in that they are designed more particularly with regard to theoretical requirements than with regard to the utmost simplicity of operation and lowest cost. Many of the European instruments are relatively complicated; being combinations of a large number of parts, many of which would appear to the American mind as unnecessary.—P. S. M.

measurement of light from a test-lamp will be proportional to the effects produced on measurements of unknown intensities.

It is very important that instruments used in measuring light from any illuminants should be calibrated with reference to light of known intensity from illuminants of similar character. It must be recognized that in many cases this is not practicable. Where it cannot be done, and particularly where the colour values or characteristics of the light are widely different from those of the light sources with which the instrument was standardized, the possibility of error should be recognized.

An excellent method of determining the precision of the photometric part of an illumination photometer is to use it in the photometry of single light sources. The instrument designed specifically for the measurement of illumination differs from the laboratory instrument used to measure candle power only in that it is equipped with an illumination test-plate, and is generally rendered portable, and so enclosed that it may be employed in a brightly lighted room. Any illumination photometer may be used in a determination of the candle power of light sources, if the proper precautions are taken. The light sources and the test-plate of the instrument should be so screened that no light except the direct rays from the source under test reaches the plate. In using an illumination photometer in this way, many large sources of error which attend the measurement of total illumination, are eliminated; and it is possible to learn more definitely the degree of precision obtainable with the instrument used as a simple photometer.

One of the great difficulties in the practical use of an illumination photometer is to be found in the variability of light intensity in most commercial installations. If the installation consists of incandescent electric lamps, this can be dealt with best by operating the comparison electric lamp from the lighting circuit, when its variation will be similar in character, if not in degree, to that of the illumination to be studied. This is known as the "similar circuit method." When an instrument is so designed that this cannot be done, or when the lighting installation consists of other than incandescent electric lamps, it is advisable to continue observations at each test-point over a sufficient period to afford a fair average result.

With any of the photometers described in this paper, it is probable that the skilled photometrist could approximately correct results; for he would locate the sources of error, determine their extent, and apply such corrections as were possible. Most errors in photometry are occasioned by failure to recognize the limitations of the instrument used. Recently there has been exhibited a tendency to forget that photometry is a science, and that one may become skilled in its practice only after he has acquired a knowledge of the fundamental principles involved, and has become experienced in the application of these principles. Instruments have been designed which apparently make so little demand for technical skill on the part of the observer as to give rise to the belief that photometry is as simple as is their operation. This has led to the publication of results which would appear to be utterly unreliable, judging from the instruments and methods employed in making the tests.

It is submitted that this Society, and illuminating engineers in general, must rigidly uphold the best traditions of the past in photometry, and must so apply recently acquired knowledge and experience that a still higher standard may be established. As the photometry of light sources and of illumination has an important place in illuminating engineering practice, we should oppose strongly the recent tendency which has already led to aspersions upon the accuracy of illumination measurements, and which, if followed, must surely bring illumination photometry into disrepute.

In closing, a few maxims are offered, which the illuminating engineer would do well to bring to bear upon photometric problems:—

An instrument must be a good photometer before it can be a good illumination photometer.

Measurement of illumination is more difficult than measurement of candle power.

In obtainiug a photometric setting, one does not necessarily determine the value of the light studied.

Every photometer is to be regarded with suspicion until its accuracy is demonstrated. It is then to be regarded with suspicion until it is shown that no change has occurred since its verification.

No photometric information is better than misleading photometric information.

The London and Southern District Junior Gas Association will hold the opening meeting of the forthcoming session at the Cripplegate Institute, Golden Lane, E.C., on Friday, the 11th prox. Subsequent meetings will take place on the second Friday in each month during the session.

The Prospect of Dustless Roads.—At the present time, it is possible for a motor-car to run for 100 consecutive miles in Kent on roads which have been treated with tar; but, according to reports received from local authorities, there is every reason to believe, says the "Daily Express," that 10,000 miles out of a total of 20,000 miles, of main roads in England and Wales will be dustless in the summer of 1908.

GAS FIRING OF POTTERS' KILNS.

At a recent meeting of the English China Manufacturers' Association, Mr. Arthur Woolley, of Longton, gave some interesting particulars with regard to experiments which he has made in firing kilns and ovens with gas—a subject to which reference has already been made in the pages of the "JOURNAL."

Dealing first with the kind of gas to be used, Mr. Woolley said that, in his opinion, Mond gas was not suitable for the requirements of pottery manufacturers. They needed a gas with a highly luminous flame, so bright that it must almost be like electric light. The more luminous the flame, the more perfect the gas for potters' ovens. He did not think there was any difficulty in applying gas firing to kilns; in fact, it was easy to use it with the ordinary or travelling kiln. The difficulty in applying gas firing to ovens had been that in an oven there was a large space of dead matter which had to be fired; and whether coal or gas was used, it required the same heating properties to get through this. Gas was of no more value than coal for getting through a mass suddenly; therefore the chief thing was to have perfect radiation. He had been working on this matter for several years; and it was now an absolutely assured success from almost every point of view—economy of fuel, preservation of brickwork, purity of colour, general cleanliness, and an almost total absence of smoke, if properly managed. He had received valuable assistance in his experiments from Mr. Fell, of Longton. In conjunction with Mr. Fell, he had made various experiments, and had secured a temperature equal to that necessary for the making of steel—namely, 2000° C. The highest temperature required for a bisque oven was from 1350° to 1400° C.; and this could be easily attained by gas, and much quicker than by present firing methods. He believed the gas-firing process could be applied to existing ovens without any expensive alterations. All that was required was to take out the mouths, and in their places put producers. The conditious were exactly the same all the way through, with this great recommendation—that, with care and attention, they were absolutely constant. So far as glost ovens were concerned, the matter was beyond the experimental stage; and, as regarded bisque ovens, for 10, 15, or 20 hours they could have hot air, devoid of flame, passing through the oven, gradually drying the ware and heating the oven. Afterwards, they could introduce the gas-flame, increasing the temperature as needed, or keeping a constant heat. They could either keep a certain temperature for 10 to 20 hours, or they could increase it at will. As producers were placed in each mouth, if, by oversight or carelessness, any part of an oveu was firing too quickly, that part could be shut off for the time being without interfering with the process of firing in another part. There had been invented and patented a system for regulating the middle by an arrangement which completely shut out, if required, any gas from passing up the middle, but still firiug the outsides, or *vice versâ*; and by this system, they could either enlarge or reduce the well-hole. He did not say they had perfected the process; indeed, he felt they were simply on the fringe of it. As to the cost, he believed they would be able to place ou the market an arrangement within the reach of every manufacturer. He did not care how old or what construction au oven was, it could be adapted to work as successfully as oue specially built. The advantages were many. He suggested there would be a saving in fuel of 50 per cent.; a saving of 30 per cent. in the period of firing; and a reduction of 95 per cent. in smoke; and, as regarded the firing of the ware, he thought he could safely say they would get a better oven after gas than coal. In his experiments, he had reached perfection with both colours and gold. He regretted they had not some organization which would take up a matter of this kiud, and carry out the experiments, instead of leaving them to individual firms.

COST OF PUMPING BY VARIOUS METHODS.

In a paper contributed to the Water-Works, Gas-Works, and Sewerage Section of the receut Engineering Conference, Mr. CHARLES HAWKSLEY and Mr. HENRY DAVEY dealt with the comparative cost of pumping by steam, internal combustion engines, and electricity, based upon actual working.

They said: To compare the cost of pumping by steam, internal combustion engines, and electricity is difficult for want of sufficient comparable examples. The thermal efficiency of the prime mover may be very high, and its consumption of fuel per work done also high, because of mechanical losses. The real economy is the sum of the thermal and mechauical efficiencies in work done. It is only on this basis that a true comparison can be made. The commercial costs are not dependent on the fuel costs alone, but also on other working expenses and maintenance. For public water supply, the drainage of mines and land, and certain other purposes, the power required is generally considerable and continuous; and it is to these applications that we propose to direct attention. In such operations, the cost of fuel per pump horse power (P.H.P.) is the most important item.

The two important questions in pumping operations are cost of fuel aud continuous working. Pumping-engines have sometimes

to run for many months without stopping, and should maintain their efficiency for some thirty to forty years with little outlay on repairs. Since the days of Newcomen, no steam-engine has been more economical than the low-speed pumping-engine. The best water-works and mining engines of to-day give one P.H.P. per hour with 12 lbs. to 20 lbs. of steam, depending on the nature of the engine and its application.

The mechanical efficiency of the steam-engine and pump combined varies from 80 to 86 per cent. The steam consumption is 10·5 lbs. to 16 lbs. per indicated-horse-power hour; being as low as that of any high-speed or other steam-engine used to produce electric current. The comparison, then, of a steam pumping-engine with electric pumping plant as regards fuel becomes reduced to a question of the comparative mechanical efficieucies of the two systems, expressed in terms of P.H.P., thus—

Direct-acting steam pumping-engines and pumps—		
Mechanical efficiency per P.H.P.	83	per cent.
Electric—		
Engine and dynamo, mechanical efficiency .	85	,, ,,
Cables, mechanical efficiency	95	,, ,,
Motor ,, ,, ...	80	,, ,,
Gearing and pumps, mechanical efficiency .	75	,, ,, *
Total mechanical efficiency per P.H.P. .	48·45	,, ,, *

The relative fuel economy in the above example is as 10 : 17 in favour of direct steam pumping.

It would appear that establishment charges and maintenance would be greater with electric plant. Electric current might, however, be supplied from a public source. We must then assume the cost per unit. The actual cost at the Neasden Station of the Metropolitan Railway is said to be as low as 0·3d. per unit—not charging repairs or interest on capital. We know of no public supply as low as 0·5d. per unit, but will adopt this figure. Taking the efficiencies given above of the cables, motor, and gearing and pumps only, 1·31 electrical units would be required per P.H.P. This at 0·5d. per unit would represent £24 per P.H.P. per annum for electrical energy alone. The cost of coal varies with the situation; but, generally speaking, in an ordinary steam-pumping establishment, it does not exceed £5 to £8 per P.H.P. per annum [see following table], or less than one-quarter of the cost of electricity at ½d. per unit.

Water-Works Pumping-Engines.

—	Engines Working both Well and Distribution Pumps, thus Pumping the Water Twice.				Engines with Distribution Pumps only.	
	A.	B.	C.	D.	E.	F.
(*a*) . .	485	563	483	370	205	93
(*b*) . .	144	125	178	125	91·5	72
(*c*) . .	100	60	60	70	130	140
(*d*) . .	8/5	7/5	8/1	9/3	9/8	8/1
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
(*e*) . .	7 1 0	7 7 0	7 7 3½	8 12 6	6 9 0	5 2 4
(*f*) . .	12 16 6	12 5 10	11 4 5½	13 9 8	19 13 10	15 13 3

Notes—(*a*) Total height of lift, in feet. (*b*) Average P.H.P., taken over the whole year (8760 hours). (*c*) Boiler pressure in pounds per square inch. (*d*) Price of coal per ton delivered in boiler-house yard; the coal used being local slack. (*e*) Actual annual cost of coal per P.H.P. (8760 hours). (*f*) Total actual annual cost of coal, stores, oil, wages, and repairs per P.H.P.

We have a record of the total working cost of a not very modern coal-mine pumping-engine, and the average cost of fuel for ten years' continuous working has been £5 6s. 10d. per P.H.P. per annum. During the ten years, the engine has averaged 264 P.H.P. continuously. At ½d. per unit, electricity would have cost £24 per annum per P.H.P. In the same district—a colliery one—the charge for electrical energy is ¾d. per unit, supplied from an electric power supply station. It thus appears that electric pumping plant cannot be economical in fuel, as compared with steam pumping-engines of moderate economy.

Gas-engines, having a higher heat efficiency than steam-engines, naturally have an advantage in fuel economy, all other things being equal. With gas-engines of (say) 200 H.P., the consumption of bituminous coal is, taking the engine-maker's estimate, 1·75 lbs. per B.H.P. The total capital outlay on engines and producers for 1000 B.H.P. is practically the same as that for compound condensing engines and boilers of similar power.

For driving machinery direct, there appears from the above figures to be an economy in fuel alone in a gas-engine over a steam-eugine; but for pumping purposes the mechanical loss in gearing between the engine and pumps would probably more than counterbalance the apparent saving. Assuming the mechanical efficiency of the gearing and pumps to be 70 per cent., then the 1·75 lbs. per B.H.P. would become 2·5 lbs. per P.H.P. There would also remain to be considered the reliability of the plant in continuous working, lubricants, and other details.

Looking at the question of consumption of fuel from a thermal-efficiency point of view, and making a comparison, we have—

	Per Cent.
Mechanical efficiency of direct-acting steam-engine and pumps combined	83
Mechanical efficiency of gas-engine alone	80
,, ,, ,, gearing and pumps	70
,, ,, ,, gas-engine and pumps combined .	56
Heat efficiency of steam-engine, say.	15
,, ,, ,, gas-engine	25

* These are variable quantities, depending on the nature of the gearing and the speed at which the pumps may be driven.

The total efficiencies are then—

	Per Cent.
Steam-engine and pumps combined	12·45
Gas ,, ,, ,, ,, ...	14·00

There remain to be considered the relative cost of coal, the additioual cost of lubricating oil for the gas-engine, and also the cost of maintenance and reliability in continuous working. In regard to oil-engines, we know of no examples that compete with such plant as we have been considering. These engines generally require, under usual conditions, about 1 lb. of oil per B.H.P.

Discussion.

Mr. Charles Hawksley, who read the paper, stated that Mr. Henry Davey had done the hard work; and, though they were both responsible for it, to him the credit was really due for the "note," which was only intended to start a discussion. It was very difficult to make fair comparisons between different motors, because so much depended upon the situation—the proximity of the coal fields—and the amount of work done. There must mostly be a man in attendance; and he could not be cut up so as to become a decimal part, to correspond with the work done by the engine. One engine might do a hundred times as much work as another, and require no more manual attention. All these things had to be taken into account before a really fair comparison could be made. Then, again, gas and oil engines were undergoing great improvements, which would no doubt increase their economy; while in a great many places the use of electricity was dictated, not by motives of economy, but rather by the convenience with which it could be applied to certain kinds of work.

Dr. G. F. Deacon (the Chairman of the day) suggested that those who had had experience with smaller units with gas aud other fuel should relate the results. The paper dealt mainly with slow-running engines, though a comparison was made with gas-engines. The capital cost was entirely left out; and this made a material difference in some cases.

Mr. Noble Anderson remarked that his experience had been chiefly acquired in Australia and New Zealand. As to the paper, it was obvious that when such a short time was allotted to so vast a subject, it was only the fringe that could be touched; and from the different aspects of the matter, it might appear that the views of one man were diametrically opposed to those of another, when a fuller explanation would show that they were absolutely in agreement. He supposed they all had a bias in favour of old friends; and the direct-acting pumping-engine was, he imagined, the oldest friend in the world of mechanical engineering. They were all familiar with it; and they liked what they were familiar with. There were some pumping-engines erected by the Melbourne Metropolitan Board of Works which gave, roughly speaking, a duty of 150 million foot-pounds of work per 1000 lbs. of steam. When, however, he came to design engines for pumping sewage at Dunedin, it struck him that the conditious there would be better met by a centrifugal pump. Those on the market were all rather low in efficiency; and so he looked round for the best, and obtained a pair of Diesel engines to work his pumps. The results secured were, he thought, better than any previously recorded for similar pumping installations. The guarantee was 1 B.H.P. per hour for 0·4 lb. of oil of 19,000 B.Th.U.; and if a better result was obtained, the Company were to have a bonus. The test occupied a month; and the Company secured a small bonus. He thought this would show that oil-engines had made a very great advance within the last few years. The Diesel oil-engine gave a thermal efficiency of 40 per cent., iustead of the 24 or 25 per cent. credited to ordinary gas-engines. The installation of two 150 I.H.P. engiues, with the centrifugal pumps, and all the valves, &c., was landed in the Colony and erected for a little over £6000; and the prices there were, roughly speaking, about 50 per cent. in advance of those ruling in this country. The plant only required one attendant. The cost of oil was 7d. per gallon. Electricity, so far as his experieuce went, could not compare with steam.

Mr. Baldwin Latham thought there was very little difference between the cost of producing power with suction gas and by the Diesel engine. There were, however, difficulties with suction gas. Of course, the question of economy depended upon the expense to which people would go to secure an efficient engine. It would pay many authorities in this country, owing to the advauce in steam pumping-engiues, to take out their old machinery and put down new.

Mr. Charles Sparks, referring to the drainage of mines, said that for electricity he thought the total mechauical efficiency per pump horse power would be 58 to 60 per cent., rather than the 48·45 per cent. given in the paper, though the latter figure might apply to surface work. In his mind, ½d. per unit was altogether an outside figure for the class of pumpiug he referred to.

Mr. Dugald Clerk remarked that his experience had been confined to pumping plants driven by relatively small gas-engines. Commercially, these engiues were limited to sizes of 100-horse power or under. The gas-engine, so far as large sizes were concerned, was still in the experimeutal stage; aud he did not think it could fairly compare with the highly-developed steam-engine of to-day with regard, for instance, to one of the requirements laid down in the paper—that it should maintain its efficiency for thirty or forty years without any great outlay in repairs. At the same time, the large gas-engine was developing very rapidly; and the problems to be solved were all clearly present in the minds of the engineers occupied with this work. In a very few years, they would have large engiues as reliable and efficient as the small

ones. At present, they gave a high thermal efficiency; but the reliability, all competent gas engineers were prepared to admit, was not equal to that of the smaller sizes. With regard to cost of suction gas plant, his firm (the National Gas-Engine Company) had many small-power engines at work; and they had nothing to quarrel with in regard to the combined efficiency given by the authors of the paper—*i.e.*, this being taken with reference to horse power of water actually pumped. It was quite common to have a combined efficiency of 14 per cent. for small pumping engines, of (say) 20 H.P. Some of the figures given in the paper were somewhat under-estimated. The heat efficiency of a gas-engine was given as 25 per cent.; but no good modern gas-engine would be so low as that.

Mr. Davey pointed out that this was comparable with the 15 per cent. of the steam-engine; whereas the latter might, of course, be 20 per cent. The two figures must be taken together.

Mr. Dugald Clerk (continuing) said he might state what had been the latest experience as to the absolute efficiency of a gas-engine. In an engine of 50 B.H.P., one expected—and always obtained—something like 35 per cent. absolute thermal efficiency; and many tests had shown as high as 38 per cent. In connection with the Institution of Civil Engineers Committee on Thermal Standards (of which he had the honour to be a member) the indicated efficiency of a gas-engine having a 14-inch cyliuder was roughly 35 per cent. This figure, if compared with the steam-engine, would come out much higher than given in the paper. It was not accurate, however, to say that this represented the combined efficiency of suction plant and engine. The thermal efficiency of a good suction gas plant, maintained at full load, was about 86 per cent.—that was, 86 per cent. of the heat contained in the fuel was given to the engine as gas—so that if they took 29 or 30 per cent., they would have the combined efficiency of the engine and producer.

Dr. Edward Hopkinson said, with regard to the statement in the paper that with gas-engines of (say) 200 H.P. the consumption of bituminous coal was 1·75 lbs. per B.H.P., he thought the figure would be more nearly accurate if it was put at 1·25 lbs. He hoped the authors would look into their figure, and see their way to correct it. He agreed with what Mr. Dugald Clerk had said with regard to the heat efficiency of the gas-engine being put too low. He was afraid that Mr. Davey's remark—that the figures were comparative only, and that the efficiency of steam and gas were both somewhat low—would hardly make the comparisons in the paper quite fair. Taking the 35 per cent. given by Mr. Dugald Clerk, the advantage would lie considerably more with the gas-engine than was shown by the authors. In making comparisons between electricity and steam, it was not fair to include the loss in cables. The proper method was to leave this out entirely.

Mr. A. H. Meysey-Thompson, alluding to Mr. Noble Anderson's remarks, said it would be rather interesting to have some figures regarding the cost of repairs in the oil-engine installation.

Mr. F. R. Phipps remarked that, as a municipal water engineer who had had some opportunity of using suction gas plant, he thought perhaps the figures he had been able to obtain might be useful. The installation put down was capable of pumping 40,000 gallons per hour—two-thirds to a low-level reservoir at a height of 75 feet, and the remaining one-third to a high-level reservoir at a height of 180 feet. The water was lifted in two stages. The total efficiency was 65 per cent. Anthracite down South was rather expensive—30s. per ton; and the quantity consumed per pump horse power was 1·19 lbs., costing 0·19d. This was calculated over six months; the engine running 11 hours a day, and the fire being kept going the other 13 hours, ready for blowing up. At Worcester, he had had an opportunity of getting figures as to electrical pumping. There were two sets of single-phase alternating electric motors, pumping 10,000 gallons an hour 300 feet, in one lift. The current was practically the same as that given in the paper—1·31 units per pump-horse-power-hour; and they could not get it at less than 1¾d. per unit. The cost thus came out to 2·3d. per pump-horse-power-hour, which it would, of course, be impossible to pay except when the money was going to another Committee of the same Council. To compete with a steam-engine just put down, it would be necessary to have the current at 0·45d.

Mr. Walter Hunter said that his partner Mr. Middleton, if he had been present, would have been able to give them some statistics with regard to pumping by a small gas-engine. The duty was extraordinarily high. Giving his own experience, he referred to a triple expansion steam pumping-engine at Hampton, the cost of fuel for which, he said, bringing everything down to the authors' basis of calculation, would come out at about £5 17s. per pump horse power per annum, which nearly corresponded with one of the results obtained by the authors.

Mr. Llewellyn Atkinson said he was surprised at the Metropolitan Railway Company's figure 0·3d. per unit for electricity, leaving repairs out of consideration. He was certain some plants could produce it at 0·2d., or very little over, for a 24-hour load. Therefore this would be a fair figure for a user who was going to take electricity from his own plant, without reckoning for profit or anything of that kind.

Mr. H. A. Humphrey said he would like to give some definite figures relating to cases in which gas power had lately been substituted for steam power in the South Staffordshire district. At one particular pumping-station, he was going to suggest that the cost had been reduced by this substitution—he was speaking of the fuel cost only—to one-quarter of what it previously was. Looking at the paper, the figure of 56 per cent. mechanical efficiency given for the gas-engine and pumps combined, certainly seemed to him to be one in which there was great room for improvement. He was associated in work some time ago with Sir Frederick Bramwell, who suggested that there ought to be a better means of utilizing gas for pumping, and one that would give a higher efficiency. Sir Frederick asked him if he would think it over. He had no time to do so then; but recently he had given the matter his attention, and had designed a pump of an entirely different kind, in which the explosion took place immediately in contact with the water. This pump had no piston, no fly-wheel, no crank-shaft, and none of the ordinary things that appertained to a pump, as they knew it, for water.

Mr. Hawksley asked whether it could be used for potable water.

Mr. Humphrey replied that it could. The gas need not come into contact with the actual water delivered, though it came into contact with the layer of water above that.

Mr. Thomas Duncanson said that his experience of water-works pumping-engines confirmed very closely the figures in the table given by the authors. He referred to several deep-well pumping-engines, the cost of fuel for which came to about £7 per pump horse power per annum; while if they were worked 24 hours a day no doubt there would be a higher efficiency. If the engines in use were of fairly decent economy, there would be no great advantage in sweeping them away and substituting other machinery, because the extra interest on the expenditure would counteract the saving from the higher efficiency. He had had no experience with gas-engiues; but he should think if one were fitting in new plant, gas or electricity should possess advantages.

Mr. W. Binnie quoted a suction-gas installation the figures of which, he said, were very low. There were three gas-engines; each unit being 16·4 pump horse power. The coal bill—burning anthracite—was 20 lbs. per hour for six months—that was, 1·22 lbs. per pump horse power.

Mr. George Gore said he had, from material in his possession, worked out a typical example of a Diesel engine and centrifugal pump. He took a 200 pump-horse-power engine, a consumption of 0·4 lb. of oil per brake horse power, 80 per cent. efficiency for the pump, and 55s. per ton as the cost of oil. The cost per pump horse power per year of 8760 hours worked out at £5 7s. 6d.

Mr. Davey was not present to reply to the remarks that had been made.

REGISTER OF PATENTS.

Rendering Incandescent Gas-Burners Self-Lighting.

Coxhead, G., of East Ham, Essex.

No. 18,601; Aug. 20, 1906.

In accordance with this invention, a series of burners, or any of the series, may, says the patentee, be lighted or extinguished from one point at will, by applying a catalyst—such as finely-divided platinum black—to the fork or suspension rod of the mantle "at a conveniently close position to the gas outlet of the burner, to be readily acted upon by the flowing gas when turned on, so as to cause ignition upon the gas coming in contact with the catalyst."

Lighting and Extinguishing Distant Gas-Burners.

Bartlett, F. G., of Bristol.

No. 21,521; Sept. 29, 1906.

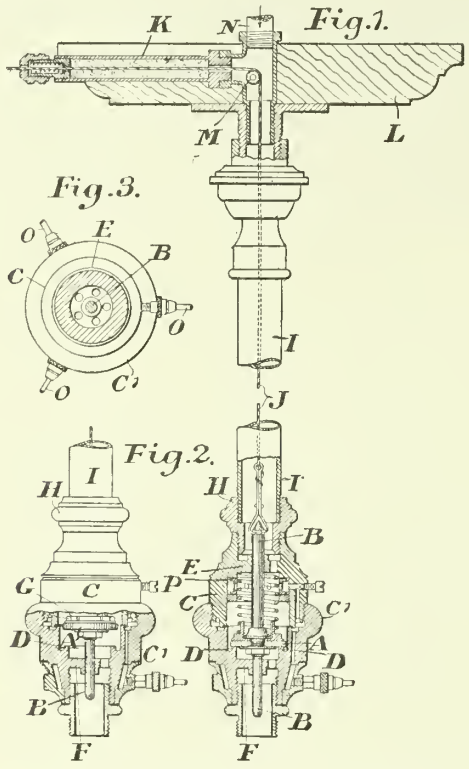
This invention relates to gas-lighting apparatus where pilot lights are used and where a spring-controlled valve is lifted, and held off its seat, from a distance by a cable and tumbler or other switch.

Fig. 1 is a section (see next page) illustrating the invention as applied to a three-light gasalier—the valve which controls the supply of gas to the branches and main burners being shown closed. Fig. 2 is a view of the valve casing and valve—partly in section and partly in elevation—shown open. Fig. 3 is a sectional plan.

The valve A, with its spindle B, is contained within a casing which consists of an upper part C and an under part C¹, into which the upper part is screwed. The valve seat D is circular; and on it rests, when the valve is closed, an india-rubber washer. In the upper part of the casing is a diaphragm E, through the centre of which the valve-spindle B passes. In the diaphragm are apertures arranged in circular series. In the lower part of the casing is a similar diaphragm F, with apertures arranged similarly to the apertures in the upper diaphragm. Between the under face of the diaphragm E and the valve is a spring G in compression, which tends constantly to hold the valve down on its seat. Screwed into the upper part of the casing is an adapter H, into which is screwed a tubular rod I, by which gas is supplied from the ordinary piping. Into the rod is passed a wire or cable J, which has a swivel connection to the valve-spindle B, so that the wire or cable cannot twist. The cable is led through a gas-tight stuffing box K placed in or near the ceiling block L; a pulley M being provided to conduct the cable round the angle. The cable has free play when moving outwards or inwards. The part of the cable which runs on the pulley is preferably a length of chain, and the part in the stuffing box is preferably a rod.

Under the diaphragm E is a ring P, backed by a tape or by cotton wool, through which gas can readily pass. The ring has apertures for the pilot-light gas to pass through to the space behind the ring in the upper part of the casing.

The wire J extends back from the valve to any point in a room, where it may be connected to a "switch" or a straining and retaining device of the usual tumbler or other type.



Bartlett's Gas-Burner Lighter and Extinguisher.

While the valve A is down on its seat D, no gas can pass out of the casing to the branches of the gasalier, and so to the main burners—the valve cuts off the gas supply thereto. But when it is required to light up the main burners, the wire is pulled upon by a strain exerted at the switch, and is retained thereby, and the valve is raised off its seat against the resistance of the spring G, which becomes further compressed between the valve and the underface of the diaphragm E. The upper part of the valve is channelled to form lateral openings or ways for the gas to pass freely out over the valve-disc in event of the spring being so tightly compressed as to allow insufficient gas to pass between its convolutions. When the cable is released from retention by the switch, the spring rebounds and closes the valve, and the main burners are extinguished.

Producing Gas and its Bye-Products from Coal and Similar Substances.

FRITZ, F., of Lauderdale Mansions, W.

No. 20,359; Sept. 13, 1906.

The object of this invention is "to obtain the greatest possible yield from gas-producing substances, which, being submitted to a glow heat, are brought in contact with water, and thereby water gas is formed, which mixes without further process with the distillation gas, so without expense producing a greater yield of gas. Should the water be blown in with air, then the nitrogen contained therein would be secured, and thereby a large yield of ammonia obtained."

The *modus operandi* is thus described by the patentee: The coal, peat, or similar substances under treatment are conducted through continuously working retorts, by means of a chain or other suitable apparatus, and are distilled. At the close of the distillation the glowing coke falls into a retort (which may be disposed vertically), and is there extinguished by a spray of finely atomized water, which, when the object is to produce ammonia, is forced in by air pressure. As soon as the finely atomized water touches the glowing coke, it is transformed into steam. The steam thus passing through the glowing coke is then transformed into water gas; and if the operation is conducted with air-blowers, the oxygen of the air will be utilized for increasing the heat of the coke, and the nitrogen of the air to increase the production of ammonia.

He further remarks: "Through this operation, of using finely atomized water, it is better capable of extracting the ammonia from coke than if the water is brought over the glowing coke or the glowing coke falling in the water, by which latter means the heated coke is immediately quenched, and consequently less steam is produced for the necessary extraction of ammonia. By using air for forcing in the water, the heat of the glowing coke lasts longer by blowing the air on the heated coke."

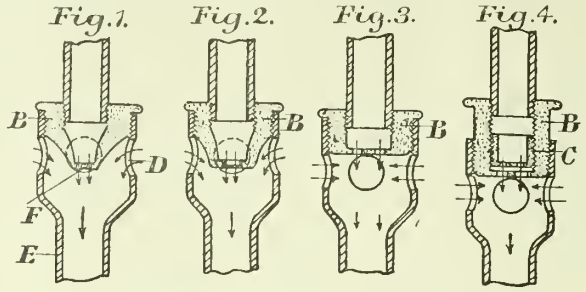
Inverted Gas-Burners.

MANNESMANN, O., of Remscheid, Germany.

No. 27,374; Dec. 1, 1906.

In this inverted gas-burner the air for combustion is previously heated by a special arrangement so that the bottom plate of the nozzle, which is provided with the holes for the passage of the gas, is surrounded by, and embedded in, a nozzle of material which is a bad conductor of heat—such as soap-stone, porcelain, or the like.

According to fig. 1, the bottom plate of the nozzle B is provided with holes F for the passage of the gas into the mixing-tube E, which has air holes D—the air for combustion supplied through these holes being previously heated in any suitable manner. This burner is said to offer the advantage that no deposit will be formed at the nozzle. A further advantage is that the end of the nozzle in which the gas holes are provided, "will not be deformed when the burner is put in place or cleaned, so that the gas-jets remain of constant direction with regard to the mixing-tube, which circumstance is very important for obtaining a uniform and steady light."



Mannesmann's Inverted Gas-Burners.

In fig. 2, the bottom of the nozzle B can be made of metal; but this construction does not possess the second of the advantages of the burner shown in fig. 1.

According to fig. 3, the nozzle B is made with a flat and horizontal bottom part, whereby "it is avoided that the air for combustion comes into contact with the side of the nozzle, but flows along the surface of the bottom plate—thus greatly facilitating the keeping cool of the nozzle."

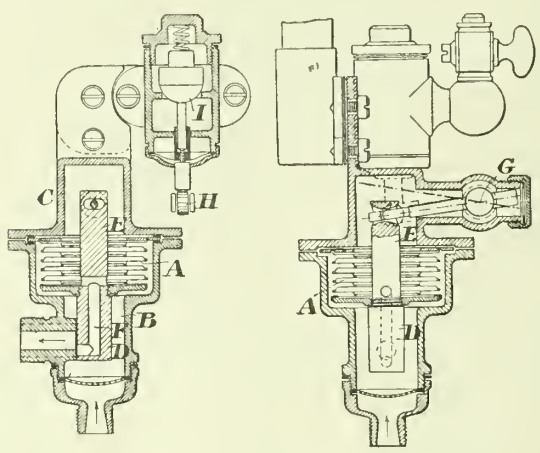
According to fig. 4, the nozzle B is furnished with an inner nozzle C, which eventually may be made from metal and the bottom plate of which has holes which are much smaller than the holes of the bottom plate of the outer nozzle, but coincide with them in such a manner that the gas flowing out through the small holes can freely pass through the other holes, even when they should be clogged. With back-lighting, this construction offers the advantage that the flame will never reach the inner gas holes but only burn at the outer bottom plate.

Automatic Gas-Valve Openers for Liquid Heaters.

DEUTSCHE CONTINENTAL GAS GESELLSCHAFT, and FRITZ MUCKE, of Dessau, Germany.

No. 28,495; Dec. 13, 1906. Date claimed under International Convention, Dec. 15, 1905.

This invention has reference to heaters in which the water flowing through is heated by a gas burner of the kind which effect the automatic opening of the gas-valve when the flow of water to the heating body is opened, and particularly to such devices when used with high-pressure heaters.



A German Water-Heater Regulator.

An elastic box A, acting as a membrane, is arranged in the casing of the gas-valve opener, and divides the casing into two chambers B C. On a plate on the lower part of the box A, and correspondingly displaced when the latter is compressed or extended, a piston or circular slide-valve D is mounted. The piston enters the chamber B, and presents at its upper part a bolt-like extension E, which projects into the chamber C. The water admission socket connected with the main service-pipe opens into the chamber B, as does also the water-discharge socket connected with the liquid heater. The latter socket is normally closed by the piston slide-valve D, and is only opened when the piston moves upwards. The valve is provided with an inner passage F, by means of which the water-discharge socket is constantly in communication with the chamber C. The bolt E is formed with a slot at its upper part, in which an arm mounted on a rotatable shaft G engages. The shaft carries on its end projecting outside the casing a lever, which, by means of a roller, acts upon a stud connected with the gas-valve I. Thus when the piston slide-valve D moves upwards for the purpose of opening the water-discharge socket, the gas-valve I is also opened by the rotation of the levers.

If the cocks for drawing-off water from the heater are closed, the same pressure prevails in both chambers B C, and the piston slide-valve occupies the position shown, in which the water-discharge socket and the gas-valve I are closed. When water is withdrawn from the heater in the first place, the chamber C empties through the passage F. By this means a difference of pressure is produced on the two sides of the elastic box A; the pressure in the chamber B being higher

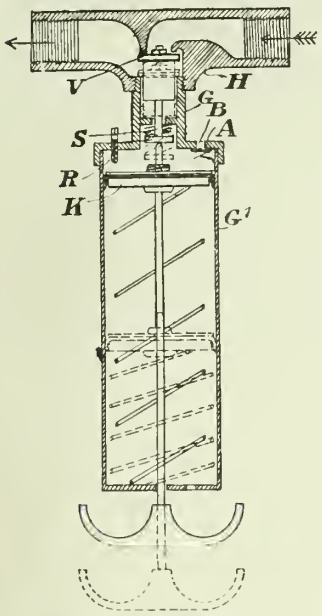
than that in the chamber C. Owing to this difference of pressure, the box A is compressed so that the valve B is raised. Owing to the upward movement of the valve, the mouth of the socket is freed to a greater or less extent, so that water is able to flow to the heater. At the same time, owing to the upward movement of the valve, the gas-valve I is opened, and the gas (kindled at an appropriate flame) heats the water flowing through the heater. When water is no longer being withdrawn from the heater, equilibrium of pressure is re-established in the two chambers B C, and the piston slide-valve D returns to the normal position shown.

Opening and Automatically Closing Gas-Pipes.

SPANGENBERG, F. A., Grosz-Salze, Germany.

No. 28,891 ; Dec. 18, 1906,

This is a device for opening and automatically closing the gas-pipes which lead to burners provided with pilot-lights, after a certain time of gas delivery—the closing of the pipes being retarded by a braking device which consists of an air cylinder and a spring-weighted piston.



Spangenberg's Automatic Gas-Pipe Opener and Closer.

The cock casing H is in (say) the gas-pipe near the street door, and in connection with a cylinder G, to which a cylinder G^1 is joined. The valve body V (preferably shaped as a circular plate, furnished with stuffing-discs at both surfaces) is connected to a piston which slides in the cylinder G. Extending from the bottom surface of the piston is a rod furnished with a disc. Between this disc and the bottom wall of the cylinder G is a spring S, which acts upon the disc so as to keep the valve permanently in an open position. G^1 represents the air-cylinder, in which is the piston K, the piston-rod of which projects with one end through the bottom wall of the cylinder, and is provided with a handle on its lower end. Between the piston K and the bottom wall of the cylinder a spring is inserted, which acts against the piston, to keep it in its highest position near the muzzle of the cylinder G.

The space above the piston K communicates with the atmosphere by the aperture B, which is covered by a flap A in the event of compressed air being contained in the air-cylinder above the piston. The compressed air can then only escape successively along the thread of a regulating screw R which fits in a female thread in the flange of the cylinder. The screw is made conical, so as to be able to adjust the space between the male and the female thread. In the bottom of the cylinder an aperture is provided, through which air freely enters and escapes.

The operation of the device is as follows: Upon entering a house, the piston K is to be pulled down by the handle, whereby the flap A opens, and air enters the space above the piston. When pulling the piston down, the spring S is released of any pressure, and exerts its power to open the muzzle of the delivery-pipe, and consequently gas flows to the burners, which (being furnished with pilot-lights) are ignited. The gas pressure acts against the piston V, and presses it with its disc tight against the edge of the cylinder G, so that no gas can penetrate the cylinder G^1. Through the piston K being drawn out, the spring around it becomes tensioned, and exerts a power to the piston upon the handle being released. Consequently, the piston is forced upwards again, and shuts at first the flap A so as to cover the entrance B. The continued action of the spring against the piston compresses the air contained in the cylinder G^1 more and more, whereby the air successively escapes through the space left between the screw R and the corresponding female thread. The piston is pushed upwards until the piston-rod projecting through the piston V reaches an abutment in the form of a disc; and upon the piston being pushed upwards again, so as to abut against the muzzle of the gas-delivery pipe, the supply of gas to the burners is cut off again.

APPLICATIONS FOR LETTERS PATENT.

8901A—2A—2B.—ALEXANDER, A. E., "Cleaning water-mains." A communication from the National Water-Main Cleaning Company. Aug. 21.

18,699.—RIGG, J., "Stoves and water-heaters." Aug. 19.

18,720.—SAMUEL CUTLER, jun., and HUSBAND, J., "Deep filled gas-purifiers." Aug. 19.

18,762.—MACKENZIE, J., "Recording apparatus for indicating water-levels or other movements." Aug. 20.

18,813.—SHAW, A., "Blowers and the like." Aug. 21.

18,815.—HOTTON, C. J., "Anti-vibrator." Aug. 21.

18,856.—PARKER, T., "Fuel." Aug. 21.

18,859.—PEAT, J. B., "Valves." Aug. 21.

18,882.—LAW, J., "Mantle-holder." Aug. 22.

18,990.—BAYES, R. J. H., and HILL, A. B. L., "Acetylene-generator." Aug. 23.

19,009.—BARDOT, E., "Gas-generators." Aug. 23.

19,036.—YARROW and Co. (BOLTON), LTD., and YARROW, M., "Joints in pipes or mains." Aug. 24.

19,082.—PARKER, T., "Apparatus for the destructive distillation of carbonaceous substances." Aug. 24.

19,100.—BERNHEIMER, J., and GUT, A., "Mantles." Aug. 24.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Socialism and Gas Companies.

SIR,—A few Sundays ago, the Socialists held a series of so-called "revival meetings" on Peckham Rye, to endeavour to drive home their specious doctrines. Among the speakers was a town councillor of Bradford and a Mr. C. W. Hartley, a borough councillor of Camberwell; also a Yorkshireman from Bradford who had been for ten years a member of the Corporation. The last-named is by all accounts a very easy and forcible speaker, who held an attentive audience for about an hour. He was interesting, because his topic was on "Coal and Gas Supply;" and, coming from the Bradford Corporation, he evidently knew the details of the gas-works there. I give some of his figures, culled from their own organ, the "Dulwich Post."

In 1871 the Municipality bought the gas-works at Bradford. They had to pay £95 for the £25 shares; but, even after that extortionate figure, the price of gas was soon after reduced from 3s. 1d. to 1s. 10d. per 1000 cubic feet. The Gas Company made the men work 82 hours for 19s. and £1 per week; but the Bradford Corporation gave 26s. for 47 hours' work. Coal has gone up in price. Some 252,000,000 tons are used in a year; and all the coal mines are worth £110,000,000. The increased price of coal brings into rich coalmen £42,000,000 a year. I would nationalize the coal mines, and pay them out in three years, and then have £16,000,000 for old-age pensions. Send 500 Socialists to Parliament and they will do that in six months. For 20 years coal at the pit's mouth cost only 7s. 3d. per ton. What do they pay for it in London? [A Voice: 27s. 3d.] Who gets all the difference? Who gets even the 7s. 3d. at the pit's mouth? Not the man who gets it out of the pit. The man who lounges in Park Lane gets 3s. 6d. of it; the collier who gets it out only earns 1s. 6d.

On being asked how he would buy the mines—where the money would come from, Mr. Hartley replied that he would do in the same way as with the Water Companies. He went on to say that Socialism was the simplest thing in the world—it would not upset anything. His advice was for them to get ready, and when they were ready it should be done. They did not want it yet; but it was waiting for them when they did.

"Lamplighter"—evidently the same orator—commenting on the subject in a leader in the above-named paper, headed "Gas Monopoly: Eternal Dividends *v.* Public Ownership," dilated on the "iniquity" of privately-owned gas-works, with an eye on the "Old Kent Road" business. Speaking of municipally-owned gas-works in the coal-bearing area and the southern gas companies' great distances from the pit's mouth, he said:

What difference does that make? The same rich men who draw eternal dividends from gas and coal are the very same people who draw them from railways. My point is that coal, gas, and railways should all belong to the people. Why should it cost more to bring 1000 tons of coal to London than to Manchester? It costs no more to deliver 1000 letters in the Old Kent Road than in Manchester. Why? Because there are no dividends to be grabbed in H.M. Post Office. You can deposit 1s. or £50 in the Post Office Savings Bank at Peckham, and take it out at Killarney or the Scilly Isles. That's State Socialism; and the same system will be used directly the people wake up to the question of coal, the supply of gas, and railway transit. As regards gas, it is the height of folly for gas workers to slave away from day to day, and then give their wages to the dividend grabbers who do nothing. There will be no trouble in buying them out. The rich men with money will only be glad to "invest" or lend it to the whole people. The other day a London County Council loan was subscribed for thirty times over.

In another part of the same paper, we are told that "the man who lights the street-lamps is of as good service to the community as the manager." Truly, this periodical is quite a "Gas issue." I note, however, that nothing was said about the contentment (not slavery) of the gas workers at the neighbouring Old Kent Road works, with their large sums invested in this co-operative Gas Company, with its bonuses and dividends to workmen, co-partnership, and workmen directors, and their share in the wealth they create—a Company who, though so far removed from the coal-bearing area, have been able to sell gas at only 2d. per 1000 cubic feet higher than the Bradford Corporation, with all their advantages of nearness to the pits' mouth. Compare this with the position of many trade unionist workmen, who for the weekly sums paid to their Union receive only "stones for bread," in lieu of a share in the industry they produce.

Aug. 27, 1907. LUX.

PARLIAMENTARY INTELLIGENCE.

CLOSE OF THE SESSION.

The remaining Bills in which our readers are interested—viz., the Colne Valley Water Bill, the Llandrindod Wells Gas Bill, the Metropolitan Water Board (Charges, &c) Bill, the Metropolitan Water Board (Various Powers) Bill, and the Renfrewshire Upper District (Eastwood and Mearns) Water Bill—duly received the Royal Assent; and Parliament was prorogued last Wednesday.

The Export of Coal.

In the House of Commons on Monday last week, Mr. Fell returned to the subject of the export of coal by asking the President of the Board of Trade (Mr. Lloyd-George) whether the latest returns showed any slackening of the abnormal demand for coal from the Continent; and whether he could give the amount of the export from the United

Kingdom during the months of June and July of each of the years 1905, 1906, and 1907. In a printed reply, Mr. Lloyd-George said he was informed, on inquiry at the Customs, that there was at present no indication of a slackening in the demand for British coal on the Continent. He appended the following statement, giving the figures required by the honourable member:—

	Exports to European Countries.	Exports to Other Destinations.	Total.
1905—June.	3,153,421 tons	675,835 tons	3,829,256 tons
July.	3,423,086 ,,	708,987 ,,	4,132,073 ,,
1906—June.	3,571,938 ,,	693,879 ,,	4,265,817 ,,
July.	4,128,940 ,,	898,222 ,,	5,027,162 ,,
1907—June.	4,405,584 ,,	915,509 ,,	5,321,093 ,,
July.	5,259,453 ,,	839,210 ,,	6,098,663 ,,

In a letter to "The Times" on Thursday last, Mr. Fell reminded the readers of that paper that Sir George Livesey considers that the present excessive price of coal is largely due to its increased export from this country since the duty of 1s. a ton was taken off by Mr. Asquith; while that gentleman himself, in reply to questions put to him in the House of Commons, declared that he disagrees with Sir George Livesey, and holds that the increased export of coal is not in any way owing to the taking off of the duty. Mr. Fell then quoted some of the above figures, and said: "It is difficult, in face of these figures, to contend that the abolition of the duty in 1906 did not stimulate the foreign demand for our coal. The question, however, remains whether the advantages of the increased export are not hardly purchased at the expense of our manufactories, which in the case of our malthouses are now paying 7s. a ton more for coal than last year, of our railways, our steamship lines, our gas-works, and, above all, of our home consumers, who will have to pay this winter 3s. or 4s. a ton more for their coal than they paid last year. A long, hard winter and dear coal is not a pleasant prospect to look forward to."

MISCELLANEOUS NEWS.

PRESENTATION TO DR. JEFFERY, OF EASTBOURNE.

Fifty Years a Gas Director.

As briefly mentioned in another column, the proceedings at the last half-yearly meeting of the Eastbourne Gas Company were of an unusually interesting character from the fact that opportunity was taken on that occasion of testifying the shareholders' appreciation of the services rendered to the Company by the Chairman—Dr. G. A. Jeffery, J.P.—during his half-century's membership of the Board (to which he was re-elected at the meeting), by the presentation to him of a massive silver salver, accompanied by an album containing the names of the subscribers to the testimonial.

Dr. Bransby Roberts, in making the presentation, said he had been honoured, as the mouthpiece of the Committee and subscribers—and he must add, he thought, as an old friend—by being asked to perform the very pleasant duty of expressing on their behalf their most cordial congratulations to Dr. Jeffery on his being again elected a Director of the Company—an event, he supposed, if not absolutely unique, still very nearly approaching to it when they considered that he had now filled the important positions of Director and Chairman for half-a-century. There were few who had had the privilege of the friendship of the Chairman and of watching his career so long as he (the speaker) had; and when he mentioned that the period exceeded fifty years, he thought they would agree with him that it was a long one. His career was always a distinguished one. In the early period to which he had referred, when the population of Eastbourne numbered about 4000, the Gas Company were fortunate enough to enlist the energies of Dr. Jeffery; and, thanks to his wisdom and acumen, ably seconded by the co-operation of the Board of Directors and the staff, the Company from that date had really never looked back, but had progressed with the times. He might, perhaps, be allowed to interpolate a few figures which had been placed in his hands. There was a copy of the report of the Directors of Aug. 17, 1857; but he would pass over that, and merely give a comparison between that date and the present time. The consumers had grown from the 215 of which they were rather proud in those days to 8390. The total receipts for gas sold to private consumers for the year had risen from £787 to £53,808; and those for gas employed for public lighting from £235 to £5212. Lastly, the 5 per cent. dividend of the past was now 15 per cent. As he had said, the Company, progressing with the times, had become the valuable institution and financial success which they saw to-day—adding to the comfort and well-being of thousands of all classes of society, from the lowest to the highest. He need hardly remind those present that, though they had been thankful for, and applauded, this success, it had not been attained without the exercise of unceasing vigilance and business capacity. Periods of much anxiety must occur in any company both from without and within; and upon the Chairman and Directors especially fell the stress of meeting these difficulties as they arose; and without both tact and resourcefulness on the part of the Chairman these difficulties could never have been so readily surmounted. In fact, he might say that Dr. Jeffery had been a tower of strength to the Company ever since he took a prominent part in its affairs. To mark this, he (the speaker) had been deputed, on behalf of the subscribers whose names were inscribed in the album, to ask Dr. Jeffery's acceptance of the salver, as a slight memento of their gratitude for past services, and as a feeble expression of their good wishes for the future—hoping that he might be spared for many years of usefulness and happiness.

Alderman Miles (the Mayor of Lewes) also spoke, bearing testimony to the high esteem in which Dr. Jeffery was held not only in Eastbourne but beyond the limits of the borough.

Dr. Jeffery, who was evidently very deeply moved, briefly replied. He said he should value the gift as long as he lived, as an expression of kindness—not only to himself but to his family—for the little he had been able to do in connection with the Company. It was true that he became a Director fifty years ago, and was elected Chairman within three years. Therefore he had seen everything connected with the Company. He had sat with colleagues and friends—some living, some gone. He thanked the subscribers sincerely for their kindness in giving him this piece of plate, which he should prize all his life, and which would be treasured by those who came after him.

On behalf of the Directors and the principal officials of the Company, Alderman Towner presented to Mrs. Jeffery a handsome silver rose-bowl; and, at her request, the gift was acknowledged by Dr. Jeffery.

Mr. H. E. Jones, the Company's Consulting Engineer, as the senior officer, asked the acceptance by Dr. Jeffery's sons and daughters of a very striking likeness of their worthy father, handsomely framed.

Mr. F. A. Jeffery, who returned thanks, said they should always value the picture very highly.

Referring to the meeting and the presentation, the writer of "Local Notes" in the "Eastbourne Gazette" last Wednesday said: "Business and pleasure were happily blended at the half-yearly meeting of the shareholders of the Eastbourne Gas Company on Monday afternoon. Notwithstanding the increased cost of coal, the customary substantial dividends were declared; and the Directors will do their best to keep down the expenditure and maintain the profits at a satisfactory figure. After the customary resolutions had been submitted and adopted, a presentation was made to Dr. G. A. Jeffery, J.P. (the Chairman), in recognition of his services as Director during the past fifty years. The sum obtained represented the contributions of a large number of the shareholders, who found a spokesman in Dr. Bransby Roberts. It is well known that the position of a director of a prosperous gas company is coveted by many, and that it carries with it certain emoluments. Dr. Jeffery and his colleagues can fairly claim that they have pursued a progressive but prudent policy; and a fair share of credit must be accorded to the Resident Engineer and Manager and to the Secretary (Mr. J. S. Garrard). Mr. Hammond resides at the works; his attention to his duties is unremitting; and instead of advocating costly appliances, he is constantly endeavouring to secure what, from his point of view, is the one thing needful—economy of production."

THE EARLY DAYS OF GAS IN LONDON.

The "Globe" last Tuesday contained the following extract from the number published on the corresponding date one hundred years ago. It related, as will be seen, to the intended formation of a National Light and Heat Company.

1.—Fifteen thousand subscriptions filled early on Thursday, the 18th August, and the last five thousand are now selling at 50 per cent. advance.

2.—All reserves must be paid before the 1st September, or be relinquished in favour of the present subscribers.

3.—To obviate the immense pressure of my rooms on Wednesday evenings, no admissions can be under 5s., or three for 10s. 6d. The free and the 1s. admissions of subscribers must also be suspended, in order that the audience may not annoy themselves.

4.—The noblemen and gentlemen trustees wishing to give public proofs in lighting the fronts of both Houses of Parliament, Treasury, Somerset House, Mansion House, Bank, East India House, Pall Mall, Grosvenor, Portman, and Finsbury Squares, and Cheapside, for which I am to ask permission and prepare estimates, &c., my time will be fully employed, as to render it impossible to attend my office for explanations, which may be had by printed questions and answers, and other publications of mine.

J. Winsor,
Inventor and Patentee of the Gas Lights,
97, Pall Mall.

N.B.—The deed remains for signature at the office every day from ten till four o'clock; but several distant subscribers may join in the cost of one power of attorney, which may be had at the office, and sent round to them for any period, to sign in their name.

GAS LIGHTING AT FRANKFORT-ON-MAIN.

The report for 1906-7 of the Frankfort Gas Company, who have a working agreement with the Frankfort undertaking of the Imperial Continental Gas Association, states that the price paid for Australian shale, f.o.b. Sydney, was the same as in the preceding year, as the result of a contract extending over several years. In the case of the requirements for Scotch cannel coal, an exceptional opportuntity was afforded of obtaining a portion of the tonnage needed by taking over a part of the stock of a German gas-works; while the remainder was procured directly from Scotland. The price, including the export duty, was somewhat less for cannel sorts than in the preceding year. Difficulties arose in the delivery of native gas coal from the pits concerned; and the deficiency, which amounted to as much as 40 per cent. of the monthly quantities contracted for, compelled the Company (for the first time since 1890) to have recourse to English gas coal, the prices being materially higher than the native quotations. The expenditure on the raw materials used was 3¼ per cent. greater than in 1905-6. The total sales of gas increased by 2 per cent. The consumption for cooking, heating, and engine purposes again experienced a material augmentation, and the public lighting was proportionately higher; but the use of gas for private illumination at the full agreement price declined. Larger quantities of tar were sold, although at depressed prices; but a somewhat greater profit was realized from the increased production of sulphate of ammonia. Including the balance forward, the net surplus profits available for disposal amounted to £22,501, as compared with £23,856 in 1905-6; and a dividend of 10 per cent. has been declared, being at the same rate as in the preceding year.

THE GAS SUPPLY OF BRIGHTON.

Interesting Reminiscences.

The Brighton and Hove General Gas Company will hold their half-yearly meeting on the 13th inst., on which occasion the Directors will report that the sales of gas in the six months ending the 30th of June were greater to the extent of 1·56 per cent. than those in the corresponding period of last year; while the rental was £1743 higher, and the net revenue from residual products £2132 more. The accounts show that the receipts from the sale of 593,708,600 cubic feet of gas amounted to £84,874; the rental of meters, stoves, and fittings to £8286; residuals produced £18,221; and the total revenue was £111,682. The principal items of expenditure were: Manufacture of gas, £55,365 (coals, coke, and oil costing £39,163); distribution, £17,501; rents, rates, and taxes, £4483; and management, £4742. The total expenses were £83,287; leaving £28,395 to go to the profit and loss account. The balance available for distribution is £38,246; and the Directors will recommend the payment of dividends at the rates of 6 and 4 per cent. per annum on the "B" and "C" preference stocks, and of 11¼ and 8¼ per cent. per annum on the original and "A" ordinary stocks. The payment of these dividends will absorb a sum of £24,236, and leave £14,010 to be carried forward. The Company's authorized capital is £695,000, of which £595,517 (including premiums) has been paid up; and the loan capital is £112,920. The total capital received is therefore £708,437; but to this must be added a sum of £2317, premiums received on debenture stock—making £710,754. The net amount expended up to the 30th of June was £653,299; so that there is an unexpended balance of £57,455. The Company have a reserve fund of £55,534, an insurance fund of £8362, and a depreciation fund of £7601. This is the present position of the Company; and as the current year is the centenary of gas lighting, and reminiscences of the early days of gas undertakings are of more than usual interest, it may not be out of place to reproduce some particulars in regard to Brighton which appeared in the "Sussex Daily News" on Monday last week.

The first mention made of the subject in local records is the Act of Parliament, dated 1818, which incorporated the Brighton Gaslight and Coke Company. At that period Brighton was circumscribed within a comparatively small area; and, roughly speaking, there were about 24,000 inhabitants and 3947 houses. The original Company was consequently a small affair. For some reason not easy to understand, they selected the high ground at Black Rock for the site of their works. From an engineering point of view, there were two objections to the site. It was not orthodox practice to put gas-works on top of a hill, from which height the product had to be forced down to the lower level; and it was scarcely economy to select a pitch so far away from a coast harbour which might be used for supplies of coal. The pioneers of gas in Brighton, however, had an ingenious way of overcoming the latter point. They brought the coal round from the North in small coasting vessels, which managed to discharge the cargo on to the beach at Black Rock, whence the coal was hauled through a subway in the cliffs into the retort-houses beyond. The passage is still in existence, though closed up; and there are also to be seen the remains of the machinery used in the process of transferring the coal from the beach. It is possible that this arrangement was carried out in order to avoid the coal dues which had been enforced for some years to defray the expenses of sea defences. If the coal had been unshipped at Shoreham, it would have been brought into the borough *en route* to the gas-works at Kemp Town, and the levy would have been imposed upon each ton. By landing the coal just outside the jurisdiction of the Town Commissioners, the Company saved the dues, which may have compensated for the labour of hauling it up the cliffs.

What price was charged for gas in 1820 or what the Company had to pay for their coal, it has not been possible to trace. Whether the cost was prohibitive to the manufacturer or the consumer cannot be established; but it is certain the Company did not make much headway until 1824, when, according to a reference book, the Old Steine was first illuminated with gas. The circumstance is mentioned so specifically that one infers that this was the initial experiment in public lighting in Brighton by means of gas. The Steine was at that period the fashionable rendezvous; and presumably this would be the first district in which the authorities would introduce a public improvement. The fact indicates that the Gas Company were pushing mains well into the centre of the town. Gas lighting gave increased zest to the gaieties of the Steine. The sickly flame of the oil-lamp was banished; and the new illuminant was freely used to give brilliance and *éclat* to the nocturnal revelries of fashionable celebrities.

Brighton developed marvellously between 1820 and 1825; and the Company found their monopoly challenged by the promotion of the Brighton and Hove General Gas Company in 1824. This Company was established in 1825 and incorporated in 1839. At that time the works were in the midst of fields remote from any buildings. For a number of years the two Companies were in active opposition—both supplying gas in the same streets. There was fierce fighting for customers; and it was quite common for consumers to change from one service to the other. The new Company in this respect always had the advantage over the original concern. The gas was undoubtedly of greater illuminating power, and their methods were recognized as more up-to-date. On the other hand, the pioneers held their ground stubbornly under the generalship of Mr. J. O. N. Rutter, who made a name in the gas world as Superintendent of the Black Rock works.

However much the two concerns fought for trade, they were remarkably united in the price they charged for gas. When gas-meters were introduced, the price was as high as 10s. per 1000 cubic feet. Both Companies charged the same. When the price was reduced, it was by common consent; when it advanced, the same policy was pursued. Notifications of an increase in price in 1854, owing to the advance in the cost of coal, freight, iron, and other materials, evoked considerable indignation in the town, and a number of consumers wrote to the newspapers asking what the cost of iron had to do with the manufacture of gas. It seems that in the previous year the price of house coal had been at what was called "an unheard-of figure;" and consumers admitted that if the Gas Companies had raised their scale at that period there might have been justification for the policy. But as coal had dropped to normal quotations, and iron only affected their mains and pipes, the inhabitants regarded the demand as unwarranted. During this year, the "new" Company had a Bill in Parliament, and the authorities were urged to bring pressure to bear upon both concerns to lower their prices. Iron was admittedly dear at that period; the "boom" in railways having produced an enormous demand for the commodity. The 6s. scale did not last long. Brighton was going ahead rapidly; and the consumption of the gas expanding, the Companies soon found it desirable to lower their charges. The normal price soon became about 3s. 6d. per 1000 cubic feet, and the illuminating power improved.

It will have been gathered that up to this period the works of the two Companies were comparatively isolated at opposite extremities of the town. There is a tradition that the development of Kemp Town was checked by the existence of the Black Rock works; but an examination of old records has revealed that the interruption in the building at Kemp Town was attributed at the time far more to the proposal to establish a huge parochial cemetery in the neighbourhood than to the manufacture of gas. Much to the relief of the inhabitants, the burial-ground scheme fell through; and in another quarter-of-a century the district was relieved of the manufacture of gas. Mr. John Birch Paddon, who had come to be the Engineer and Manager of the Brighton and Hove Gas Company, carried out a bold stroke. Appreciating the desirability of getting away from the building operations in Hove fields, he decided upon removing the retort-houses to the banks of the Aldrington Canal—keeping only the gasholders in Hove. He planned the most up-to-date works at Portslade; and thus at one stroke freed Hove from the manufacture of gas and the eyesore of coal cartage. The Portslade works came into operation in 1872; and the next move in a progressive policy was the amalgamation of the two Companies, which was mutually agreed upon, and carried out by an Act of Parliament passed in 1881. This concentration enabled Mr. Paddon to stop the manufacture of gas at Black Rock, which was, of course, another immense advantage to the neighbourhood; while a substantial reduction of 3d. per 1000 cubic feet in the price intensified public satisfaction at the reorganization of the entire service. Mr. Paddon introduced many valuable improvements into the gas supply of the district. He did everything possible to encourage the authorities to improve street lighting; and in 1882 he made an arrangement with the Brighton Town Council by which the Company supplied and fitted the large octagonal Sugg's lanterns, with triple burners, along the whole of the sea-front. The entire cost of public lighting in Brighton at that period was between £8000 and £10,000 per annum. At present the Corporation are spending about £12,000 a year on electric lighting, and only about £4000 on gas. The popularity of gas in Brighton, in spite of competition, has never had a set-back. At the time of the amalgamation of the two Companies in 1882, the annual output was 639 million cubic feet; whereas last year it had reached 1169 million cubic feet.

Two years after the amalgamation of the Companies, the late Alderman Lamb boldly told his colleagues in the Town Council that it would be a good stroke of business on their part to acquire the gas supply of the district, and put into the Borough Treasury the revenue which went into the pockets of the shareholders of the Gas Company. Municipal trading had not developed into a policy in those days; and though there were many ready to accept the worthy Alderman's idea, no one ventured to put it into operation. Consequently nothing more was heard of the proposal until the year 1890, when, after a series of desultory experiments, the Corporation resolved to buy out the original Hammond Electric Lighting Company, and obtain a Provisional Order for the installation of a municipal system. Then the *quidnuncs* lifted their eyebrows, and fervently congratulated themselves that they had "not touched gas," inasmuch as they had now embarked in an illuminant which was destined to "extinguish" its predecessor in more senses than one. Much water has flown down channel since that pious aspiration. To transpose a well-known metaphor, it may be said that while electricity proposes, gas disposes. The irony of fate has never been more completely vindicated than in the relative positions of gas and electricity—perhaps one should say municipal electricity—at the present moment, after seventeen years of strenuous competition in Brighton. At a recent meeting of the Town Council, there was a discussion which suggests that members would hail with delight an exchange of their pet electricity undertaking for the prosperous gas supply. Ominous whispers of a deficit of thousands of pounds on last year's trading were in strange contrast with a report from the Borough Accountant, printed on the minutes of the Electricity Committee, which stated that the balance-sheet of the Brighton and Hove Gas Company showed a trading profit of £53,879 17s. 6d.; being equivalent to 7 5 per cent. on the paid-up capital. The Company's income for the year was £215,480, compared with £209,582 12s. 11d. for the preceding twelve months.

This contrast is striking enough in its way; but it is not more remarkable than another comparison. The gas undertaking has been in existence for upwards of seventy years, plodding on its own way with a well-ordered progress; and its development has entailed a total capital expenditure of £710,753. The electricity works of the Corporation have had an existence of seventeen years only. The total annual revenue amounts to £85,684, and the capital expenditure stands at £758,279. A Gas Company which has been able to withstand the vicissitudes of the municipal competition for seventeen years, and at the end of that period comes out with a better trading result than its rival, is an interesting local institution. The circumstance supplies another illustration of the survival of the fittest, in the sense that the result is largely due to all-round good management. For many years the Company have pursued a sound policy. There has been no garish display or loud trumpetings, but steady solid building up of a far-reaching public service, which has gained popularity on its merits. A year ago, in an important report on his annual audit of the Gas Company's accounts, the Borough Accountant drew certain examples from the item of depreciation; and he justified his own allocations under this heading in respect of municipal trading concerns by the method adopted by the Gas Company, which he characterized as "an admittedly well-managed business." The compliment was well deserved.

PROVINCIAL GAS AND WATER COMPANIES.

Gas.

Three Years' Progress at Bridport.

The revenue of the Bridport Gas Company for the year ending the 30th of June last, as shown by the accounts presented at the recent meeting, was £5633, and the expenditure £4565; leaving £1068 to go to the profit and loss account. The balance available for distribution was £1414; and the Directors recommended the payment of a dividend of 7 per cent. on the ordinary shares, less income-tax, which would absorb £983. It may be mentioned that the results of the Company's working have considerably improved since the appointment of the present Engineer and Manager (Mr. W. H. Reed) in June, 1904. The average cost of coal in the three years 1902-4 was 19s. 7d. per ton, and the value of the residuals was £978. In the three succeeding years, the figures were 18s. 1½d. and £1128. The average make of gas per ton in the former period was 9914 cubic feet, of which 8565 cubic feet were sold at a price of 4s. per 1000; in the latter, the figures were 10,445 and 9074 cubic feet, at prices of 3s. 9d. and 3s. 3d., the lower figure being for gas used for power. A marked improvement is shown in respect of the residuals. The average yields per ton of coal in the three years 1902-4 were: Coke, 9·2 cwt.; tar, 8·1 gallons; sulphate of ammonia, 10·2 lbs. In the succeeding three years they were: Coke, 10·4 cwt.; tar, 9·5 gallons; sulphate of ammonia, 16·3 lbs.

Extended Works and Increased Business at Chichester.

At the half-yearly meeting of the Chichester Gas Company on Monday last week, the Directors expressed their pleasure at reporting that the extensive alterations and improvements at the works, which have already been noticed in the "JOURNAL," have been completed, and that the business of the Company continued to increase. An exhibition of gas appliances held in February last, and the experimental lectures on cooking by gas delivered in connection with it, were very successful. The revenue for the six months ending June 30 amounted to £6452, and the expenditure to £4926; leaving £1526 to go to the profit and loss account. The balance available for distribution was £2128; and out of it the Directors recommended the declaration of a dividend at the rate of 10 per cent. per annum upon the "A" stock, and of 7 per cent. per annum upon the "B" and "C" stocks, both less income-tax. The Chairman (Mr. Alfred Lass), in moving the adoption of the report, congratulated the shareholders on the completion of the extensions of the works and plant, and mentioned that all the public lamps had been converted from the flat-flame to the incandescent system. Dealing with the revenue account, he said the income from the sale of gas for the half year amounted to £4696; while for the corresponding period of 1906 it was £4564, or an increase of £132. This was highly satisfactory, when taking into consideration the reduction of 1d. per 1000 cubic feet; the price now being 3s. 3d. against 3s. 4d. this time last year. The gas made in the six months was 31,174,000 cubic feet, compared with 29,954,000 cubic feet before, or an increase of 1,220,000 cubic feet. When he mentioned that this had been obtained by the carbonization of 259 tons less coal, he thought the proprietors would agree with him that the result was satisfactory. The gas made per ton of coal carbonized was 11,019 cubic feet, against 9700 cubic feet for the corresponding period of 1906; being an increase of 1319 cubic feet. There had been 654,800 cubic feet more gas sold; being at the rate of 9886 cubic feet per ton compared with 8844 cubic feet before. Having dealt in detail with the various items in the accounts, the Chairman said the business of the Company had considerably increased during the past ten years. The quantity of gas sold in the six months ended June 30, 1897, was 17,709,500 cubic feet; whereas the quantity of gas sold during the half year ended June 30, 1907, was 27,709,500 cubic feet—an increase of 10,258,100 cubic feet, or at the rate of about 5 per cent. per annum compound. This meant that the sale of gas would double itself in about fourteen years. The price had also been reduced during the last seven years from 4s. to 3s. 3d. per 1000 cubic feet. In the past half year there had been an increase of 244 stoves and 82 prepayment meters. Referring to the rise in the price of coal, the Chairman said that, though other companies had given notice of advances in price ranging from 2d. to 5d. per 1000 cubic feet, the Directors hoped that the enhanced price of coke, the economies which the new works were designed to effect, and the expected augmentation in business, would to some extent meet the additional cost of coal. In these circumstances, they thought it desirable to await the future development of events before deciding upon either an increase in the price of gas or a decrease in the rate of dividend. In conclusion, he expressed his pleasure in stating that the Company's relationship with the city authorities was exceedingly amicable, and they desired it to be continued. Mr. W. A. Walker, the Manager of the Worthing Gas Company (who is a Director), having seconded the motion, Mr. Joseph Cash, the Engineer of the Brighton and Hove Gas Company, congratulated the Directors upon the completion of the important extensions of the works which had been in progress during the past two years, the wisdom of which was fully justified by the results now published in comparison with those of previous years. He paid a high compliment to the Manager (Mr. T. E. Pye) for the work done during the half year, the returns of which, he said, compared very favourably with those of much larger works. The motion was carried, and the usual dividends were declared.

A Judicious Purchase of Coal at Eastbourne.

At the half-yearly general meeting of the Eastbourne Gas Company on Monday last week, the Directors submitted accounts which showed a profit of £8475 on the working in the six months ending the 30th of June last; the revenue having amounted to £35,909, and the expenditure to £27,434. The amount available for distribution was £25,173; and the Directors recommended that a dividend should be declared for the half year at the rate of 15 per cent. per annum on the original capital, and also on that raised on "C" shares, and at the rate of 12 per cent. per annum on the capital raised on "B" shares. This would absorb £7837, and leave a balance of £17,336 to be carried forward. In moving the adoption of the report, the Chairman (Dr. G. A. Jeffery) remarked that during the half year to which it referred the profits had been sufficient to enable the Company to pay the usual dividends, after making due allowance for wear and tear and depreciation. This, at a time when other gas companies were trenching on their reserves or raising the selling price of gas, was a boon. They had hoped on this occasion to lower their charge from 2s. 8d. to 2s. 6d. per 1000 cubic feet; but, considering the high price of coals, they thought they were wise in holding their hands for the present. The shareholders must allow the Directors to take credit for their forethought in purchasing at a cheap rate a two years' instead of a year's supply of coal; and now, by the purchase of 10,000 tons only, they had sufficient to carry them on to next September twelvemonths. Until recently there was an export duty of 1s. per ton on coals. In a silly moment, he thought, the Government repealed this, cut off revenue from an outside source, and therefore made the foreigner the recipient of what the British taxpayer had to pay. This was hardly fair, because the great industries of the country were now burdened by this severe rise in the price of coal. There had been a satisfactory increase of 5½ per cent. in the sale of gas, and coke had sold very well; but tar had not been quite so valuable. When he looked at the excellent roads made by the Corporation of Eastbourne, he thought there might be a future for tar. Mr. A. W. Oke seconded the motion, and it was carried. The dividends recommended were then declared; and thanks were accorded to the Directors, officers, and staff. Subsequently a presentation was made to the Chairman, an account of which appears elsewhere.

Popularity of Slot Meters at Farnworth.

The half-yearly general meeting of the Farnworth and Kearsley Gas Company was held last Thursday, under the presidency of Alderman James Fletcher, J.P. The Directors reported that the balance of net profit was £2453, which with £308 received for interest on the reserve fund made a total balance of £2761. During the half year the expenditure for coal, repairs, &c., amounted to £1213 more than in the corresponding period of the previous year. The sale of gas had increased by 4¼ per cent, and during the six months 212 new consumers and 124 cookers and grillers had been added. The Chairman, in moving the adoption of the report, said the recent reduction in the price of gas had benefited the consumers to the extent of £583; and though there was a satisfactory increase in the sale of gas, the revenue from this source showed a falling off to the extent of £270 compared with the first half of the past year. He reminded the shareholders that the recent advance in the price of coal would have a serious effect in diminishing the Company's profits. The present contracts had been arranged at an advance of 2s. 6½d. per ton, which was equivalent to an increase of 3d. per 1000 cubic feet upon the previous rate. But the Directors hoped that, owing to the accumulated reserve fund, they would be able to meet the crisis without having to alter the price of gas. He concluded by referring to the popularity of the slot meters, of which, he said, 2785 were now in use—being a large increase. Dividends at the rates of 10 and 7 per cent. per annum were declared.

Increasing Popularity of Gas at Harrogate.

At the half-yearly meeting of the Harrogate Gas Company last Thursday, the Chairman (Mr. F. Barber), in moving the same interim dividend as before, reported satisfactory working in the six months ending the 30th of June, due to an increased consumption, which compared well with the corresponding period of the previous year. He attributed the favourable position of the Company entirely to the increasing popularity of gas, and to the realization of its commercial advantages over all competitors; and he looked forward, on the return of more normal conditions, to a further boom in the Company's prosperity. In view of the continued heavy demand for export coal, he considered it wiser to respect the present firmness of the market, and not be unmindful that prices might go even higher. The past half year had not been affected by the increased price; but the Company had to face in their present coal contracts an increase of 2s. 8d. per ton. He was, however, glad to be able to report that, after careful tests under working conditions, a combination of coal had been found to produce such commercial results as would largely minimize, if not entirely meet, the advance in price. Though it was unwise to prophesy, they had very good hope of maintaining their present position with the consumers without any reduced profit to themselves. They did not mean to depopularize gas by raising its price on account of the increase in the cost of coal, so long as their management, by the exercise of superior skill, were able to meet the contingency by greater efficiency in working. He congratulated the proprietors upon the high position which their stocks maintained in the market, notwithstanding the enormous depreciation which had taken place in all gilt-edged securities. In conclusion, he congratulated their General Manager (Mr. H. Wilkinson) upon his appointment to the presidency of the North of England Gas Managers' Association. This was regarded as a position of great distinction among gas managers in the North; and he knew no gentleman more deserving of the honour.

Coal Advances Fifty Per Cent. in Two Years at Hartlepool.

The Directors of the Hartlepool Gas and Water Company, in the report which they submitted to the recent annual meeting, stated that the total revenue for the year to June 30 amounted to £89,539, against an expenditure, including interest on loans, of £57,461; leaving a balance of £32,078. An interim dividend was paid in March last, and the Board recommended the declaration of a like dividend for the past half year—namely, at the rate of 5 per cent. per annum on the whole of the paid-up consolidated capital of the Company, less income-tax. The quantity of gas sold during the year was 396,951,640 cubic feet, an increase of 1,295,431 feet upon the previous year. The sale of water had also been satisfactory; and there had been a constant and ample supply available throughout the year for both domestic and trade purposes. The large quantity of soft water in store in the Company's reservoirs at present constituted a record for this season of the year. A telescopic gasholder erected at No. 1 gas-works in 1864 had for some years back shown signs of rapid deterioration; and at the present time it was being replaced by a three-lift columnless holder of the most modern construction, having an increased capacity of 50 per cent. The Chairman (Mr. Thomas Appleby, J.P.), in moving the adoption of the report and balance-sheet, referred to the great increase in the cost

of coal. By strict economy, he said, the Directors had during the past year been able to avoid raising the price of gas, and to recommend the payment of the maximum dividend and carry forward a balance of £155. He wished he could speak hopefully for the current year. The price of coal had risen to such an extent as to represent on this year's contracts an increase of £7500 above last year. On the two years, the price of coal had advanced about 50 per cent. The Directors fully realized that the shareholders were entitled to a maximum dividend of 5 per cent. (which only represented about 4 per cent. upon the market value of the stock, and was certainly not too much). They hoped to accomplish this without having recourse to raising the price of gas; but should it be necessary, they would not hesitate to do so—believing that the consumers would recognize the reasonableness of such action under the exceptional circumstances. To meet the extra cost of coal, they looked for increased revenue from the sale of residuals, especially coke, and also from the sale of water; while it was also hoped to effect a further reduction of expenditure. But should these hopes not be realized, they would be compelled to raise the price of gas. The sales of both gas and water had been satisfactory; and the Directors had for some time past been overhauling and renewing the plant, with a view to being ready to meet further requirements. It was expected that the new gasholder referred to in the report would be ready for work on Oct. 1. The consumption of gas through slot-meters continued to increase steadily, no fewer than 425 additional consumers having been added during the year; making a total of 7033 of these meters in use, which contributed nearly £8000 to last year's revenue. Sulphate of ammonia had maintained a steady attitude during the year, the variations in price having been less than usual—due, no doubt, to the continued increased export of the material to Japan and Spain. This was still one of the best and cheapest artificial manures; and those farmers who during the late wet season had used it in preference to nitrate of soda, would have fully realized its advantages. The tar market had been very flat most of the year—receipts from this source being nearly £250 less; and so long as the large quantities of tar now produced by colliery owners and others at coke ovens continued to be put on the market, there was little prospect of the product improving in price, unless new markets could be found for its use. Local authorities having charge of highways would find it serviceable and economical for their roads and footpaths both in construction and durability, and also as a means of diminishing dust. Of Coalite much had been said, and great hope was entertained that by its use the smoke nuisance in large cities and towns was doomed. All must welcome any innovation tending to clear the atmosphere of the great amount of impurities it now contained, and much of which was quite avoidable. The report was adopted.

Steady Progress at Salisbury.

Presiding at the annual meeting of the Salisbury Gas Company, Mr. George Fullford, J.P., was happily able once more to congratulate the shareholders on the satisfactory position of the undertaking. Referring to the accounts, he said it would be seen that there had been a reduction on the cost of coal as compared with the previous year; while wages and repairs showed a slight increase, and distribution charges were somewhat higher. In regard to income, there was an increase all along the line—in sales of gas, of residuals, and rents of meters and appliances. On the whole, the accounts were very satisfactory, and showed sound and steady progress. The balance on the right side would enable the Company to tide over the large advance in the price of coal, which, on the current year's contracts, amounted to about £850, and avoid raising the price of gas to the consumers. They had always been willing to adopt improvements of proved utility; and the new regenerator furnaces in the retort-houses, and the enlarged purifying apparatus lately erected to the design and under the control of their Engineer and Manager (Mr. Norton H. Humphrys) were doing good work—making better gas at a lower cost. The slot-meter was a growing department of the business; and the maintenance in good order of incandescent burners by their staff of skilled workmen, for both inside and outside lighting, continued to give great satisfaction. The stock of stoves and cookers on hire had been added to during the year; and the Directors were thoroughly satisfied with the loyal support they had received from the officers and staff, and the large number of men engaged in the numerous departments covered by their operations. The report and accounts were adopted. At a subsequent extraordinary meeting, the Directors were authorized to raise £2500 of 4 per cent. debenture stock.

A Record Report at Tonbridge.

The half-yearly meeting of the Tonbridge Gas Company was held on Monday last week. In moving the adoption of the report, the Chairman (Mr. John Fagg) said it was the best and most satisfactory one he had had the pleasure of submitting to the shareholders. The Directors had reduced the price of gas from 2s. 10d. to 2s. 8d. per 1000 cubic feet from the 1st of January last—a price which compared favourably with that charged in any other town similarly situated in the South of England. Under the sliding-scale clauses of the Company's Provisional Orders, this reduction entitled the shareholders to an extra ½ per cent. in the rate of dividend on the "A," "B," "D," and "E," stocks; and this statutory increase the Directors recommended. Though the price of gas had been reduced by 2d. per 1000 cubic feet, the amount received from its sale and from meter and stove rental for the six months ending the 30th of June was £283 more than for the corresponding period of last year. The reduction accounted for £350; but this amount had been made up and the revenue improved by £283 by the extra quantity of gas sold. The increase in consumption for the half year was 3¾ million cubic feet, or 9 per cent, and was three times the increase for the whole of last year. Residuals also showed a very satisfactory improvement. A considerable quantity of tar had been sold for spraying roads; and it had been sent to different parts of the county for the purpose. The Directors regretted that this year's coal contract showed a very substantial rise in the price they had to pay; but they hoped that, by studying every economy, gas might still be supplied to consumers at the present exceptionally low figure. The Directors had decided to lay a high-pressure main in the High Street, for the purpose of supplying high-power lamps to consumers. The balance on revenue account was £2518, and added to the amount brought forward, made a total of £6770 available for distribution. The Directors recommended that dividends be declared at the rates of 12½ per cent. per annum on the "A" stock and 9½ per cent. per annum on the "B," "D," and "E" stocks. This was agreed to. A hearty vote of thanks was accorded to the Chairman and Directors, as well as to the Engineer and Secretary (Mr. James Donaldson).

A Rise in Price at Truro.

The report which was adopted at the annual meeting of the Truro Gas Company stated that there had been a steady increase in the business, notwithstanding the growing competition of other forms of light and power. The continued rise in the cost of coal and freights had given the Directors much anxiety; and as they were unable to renew contracts at prices anything approaching those ruling last year, they were most reluctantly compelled to announce an increase in the price of gas of 2d. per 1000 cubic feet, to take effect from the 1st of July last. Owing to the reduction in the price of gas supplied to large power users, the net revenue from gas sold showed a decrease, though the total quantity sent out had slightly increased. This, together with the greater cost of coal, accounted for a slight reduction in the profit earned. Out of the balance standing to the credit of profit and loss account—£1822—the Directors recommended the payment of a dividend at the rate of 5 per cent. per annum, less income-tax, which would leave £41 to be carried forward to the next account. In order to clear off the temporary loan of £1500 from their bankers, rendered necessary by the purchase of the freehold of the gas-works and the extension of the works, and to provide additional working capital, the Directors recommended that they be authorized to issue additional 4 per cent. debenture stock to the extent of £2000.

A Cheerful Message to Consumers at Weymouth.

The report presented at the recent half-yearly general meeting of the Weymouth Consumers' Gas Company opened with the satisfactory statement that the quantity of gas sold in the six months ending the 30th of June was, in round numbers, 50 million cubic feet—being an increase at the rate of 4·9 per cent. on the sale in the corresponding half of last year. The Directors were able, on the 1st of April, to make a further reduction of 2d. per 1000 cubic feet (from 3s. 2d. to 3s.) in the price of gas, notwithstanding that the outlook in the coal market was not satisfactory. The prominent factors in the accounts accompanying the report were the reduction in price, a diminished yield from residual products, the increased cost of coal, and an advance in rates. This combination of circumstances naturally caused the profit to be somewhat less than usual. The amount available for distribution, however, (£4908) justified the Directors in recommending the declaration of a dividend for the half year on the ordinary stock at the maximum rate of 5 per cent. per annum, less income-tax. The number of consumers continues to show a steady increase, and the output of gas has reached a point at which it is necessary to provide further storage accommodation. The Directors have therefore entered into contracts for the erection of an additional two-lift gasholder, with steel tank, which it is hoped will be in use early next year. In moving the adoption of the report, the Chairman (Mr. J. E. Robens) prefaced his observations on the work of the half year by an interesting account of the early days of gas lighting at Weymouth. He remarked that though illumination by coal gas was started in London in 1807, it was not until 1832 that it was adopted at Weymouth. When it was introduced by Mr. Burdon (one of their representatives), who built the works and established the first Gas Company, the illuminating power was 10 candles, and the price 12s. per 1000 cubic feet. In 1835, when he (the speaker) began business, it had been reduced to 10s.; and then, as they all knew, it went on falling until it came to 5s. 6d., which was the price when the Company was formed. They purchased the old concern and had carried it on ever since. The price of gas was reduced at once to 4s. 6d., and the illuminating power rose from 10 to 14 candles. They considered they had carried on the business to the general satisfaction of the public. From 5s. 6d., which was the charge when they purchased the undertaking, they had reduced the price to 3s. Looking back through the century, what changes had taken place and what improvements had been made in gas! If it were removed now, it would not only mean that lighting power would be taken from the streets, but their domestic affairs would be affected; for gas had now entered into almost every house in some way or another for the benefit of the householder. Passing on to deal in detail with the items in the accounts, the Chairman mentioned that the rates were £160 more than they were in the previous half year. This was a matter to which they did not intend to submit quietly; for they had entrusted it to Mr. Valon, who was well known to the Board, and nobody was better acquainted with matters appertaining to gas-works than he. Referring to the reduction made in the price of gas, the Chairman combated a statement made by the Chairman of the Electric Lighting Committee of the Corporation to the effect that this concession to the consumers was due to the influence of the Committee. He said nothing could be more untrue. They had reduced the price because they had a surplus which they felt belonged to the consumers. In five years they had lowered the price of gas to what it was at the present time, and they had given to the consumers £3500 by these acts because they had had cheap coals, and also by the large additions made to the number of consumers, which naturally had enhanced the profits. With regard to the present price of coal, they were not afraid of the future. They had a good reserve, and if the high price lasted a year or two, and they had the same income as at present, they would be prepared for it. They intended to keep the price of gas at 3s., and give the consumers the benefit of it. Mr S. J. Fowler seconded the motion, and it was carried unanimously. A vote of thanks having been accorded to the Chairman and Directors, the services of the Engineer and Manager (Mr. D. F. Colson), the Secretary and Accountant (Mr. E. Y. Wood), and the employees were duly acknowledged, and the proceedings closed.

Coal, Coke, and Gas Prices at Wolverhampton.

At the meeting of the Wolverhampton Gas Company last Tuesday, the Directors, in their accounts and general balance-sheet for the six months ending June 30 last, stated that the net profit amounted to £9791. This, added to the balance brought forward, enabled them to

recommend the payment of dividends at the same rates as last half year —viz., 3 per cent. upon the preference stock, £5 2s. 6d. per cent. upon the consolidated stock, and £3 2s. 6d. per cent. upon the new ordinary stock, all less income-tax—and to carry the balance of the dividend undivided (£459) to the reserve fund. They further recommended that £228, interest for the half year, be placed to the credit of the reserve fund, and likewise £44, also interest, to the credit of the insurance fund; and that the balance of £7292 should be carried forward. The Chairman (Mr. B. O. Clark), in moving the adoption of the report, said every year showed improvement in the position of the Company. More gas was being made; and he had no doubt the higher quality of the coal employed was the reason for it. The question of the price gas coke would fetch next winter would have to be considered, and if it did not realize more, the charge for gas might have to be increased. The Directors would be sorry to do this; but though they had made their coal contracts in advance, their outlay for coal was much greater, and this would have to be recouped from somewhere. The number of prepayment meters in use had been increased by about 1000 during the past six months. The report was adopted, and the dividends recommended were declared.

Water.

Excessive Consumption of Water at Barnstaple.

Presiding at the recent meeting of the Barnstaple Water Company, Mr. C. E. R. Chanter referred to the satisfactory position of the undertaking both as regards the condition of the works and finances. The revenue, which amounted to £1776 for the half year, was £60 more than in the corresponding period of last year; while the expenses had amounted to only £705, as against £872. The construction of the new filter-bed had been completed; and the Company now had four filter-beds, three of which had been added since 1888. The Company were now sending into the town 880,000 gallons of filtered water per day, which was equal to 63 gallons per head of the population. Though their resources would amply meet a far larger demand, it was an extraordinary consumption; and he hoped the inhabitants of the town would be more careful. It was decided to pay dividends of 10s. and 7s. per share on the two classes of shares, with an addition of 1s. on account of back-dividends in the case of the older shares.

Drought Affects Revenue at Brymbo.

At the recent meeting of shareholders in the Brymbo Water Company, under the presidency of Sir Theodore Martin, the report and accounts presented showed that 4443 houses, &c., were now supplied with water—an increase of 110; but that the revenue was less than in the previous year by £133. Including a balance of £386 carried forward, the net revenue amounted to £3109. After deducting the interim dividend of 4 per cent. per annum paid in March, besides the interest on debentures, there remained a net balance of £1411 available for distribution. The Directors recommended that a dividend sufficient to make 4½ per cent. for the year be declared, free of income-tax, and that the sum of £136 be carried forward. Sir Theodore Martin, in moving the adoption of the report, remarked that the decreased revenue was due to the lamentable drought last year, which necessitated the curtailment of the trade supply. There was just as great an excess of rainfall this year as there was a scarcity last year. The Llyncyfynwy reservoir had been cleaned out, and its capacity enlarged from 50 million to 100 million gallons. This would increase the Company's storage from 100 million to 200 million gallons. The report was adopted.

An Increasing Supply in South Staffordshire.

At the half-yearly general meeting of the South Staffordshire Water Company last Thursday, the Directors reported that the number of houses laid on during the six months ended June 30 last was 1242; making the total supplied 132,299. The gross amount of water-rates was £70,117, against £67,678 in the first half of the previous year. After providing for interest on debenture and preference stock, the amount remaining for distribution, including £7249 brought forward, was £30,000; and the Directors recommended a dividend for the half year on the ordinary stock at the rate of 7 per cent. per annum. The amount of the dividend being £22,407, there would remain £7593 to the good. The Chairman (Mr. Frank James), in moving the adoption of the report, remarked that those of the proprietors who took an interest in the Company and attempted anything like a comparison of accounts would be struck by the peculiarity of the statement now presented, which, with a very few trivial exceptions, showed an all-round increase. Dealing first with the charges upon the debit side of the profit and loss account, they found that there were increased engine charges, maintenance of works, wages, salaries, commission, rent, rates, income tax, and incidental and law charges. He thought that they might deduce from these facts that the business was progressing. Engine charges showed an increase of £165; but as there had been 100 million gallons more water pumped than in the first half of last year, he thought the shareholders would see that the increase was only commensurate with the extra amount of work done. The maintenance of works account—£7495—showed an increase of £868. In a concern like theirs, having fourteen pumping and re-pumping stations, repairs must of necessity go on. The credit side of the account showed the prosperity of the undertaking. Speaking of the balances in the hands of the Company, he pointed out that they were expecting an increase in the price of coal. The supply of the Company was a pumping one, and the population dependent on them was 551,500; and as they required a large supply of coal, it was a good thing to have a balance for equalizing the dividends. Alderman Beale seconded the motion, and it was carried unanimously.

Increased Storage at Wrexham.

At the recent meeting of the Wrexham and East Denbighshire Water Company, the accounts which were presented showed a profit of £6891 on the working in the year ending the 30th of June; and a sum of £7204 was available for distribution. The Directors recommended the payment of dividends at the rates of 6½ per cent. per annum upon the consolidated stock, and 4½ per cent. per annum upon the ordinary stock, both free of tax; and this was agreed to. The large storage reservoir at Ty Mawr, the construction of which has occupied the attention of the Directors for some years past, has been so far completed as to permit the impounding of water. The need for this reservoir was unfortunately made too apparent during the summer of last year, when, owing to the prolonged drought, it became necessary to curtail the constant service to consumers. With the additional storage now provided, the total quantity of water to meet prospective requirements will be 170 million gallons, compared with 40 millions hitherto available—an increase in the Company's resources which the Directors believe will place them in a position to meet every contingency.

BARNET DISTRICT GAS AND WATER COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday, at the Holborn Restaurant, W.C.—Mr. A. H. Baynes in the chair.

The Secretary (Mr. Ernest W. Drew, F.C.A.) read the notice convening the meeting; and the Directors' report and the accounts were taken as read.

The Chairman, in moving the adoption of the report and accounts, said there were a few facts in connection with the working of the past half year to which he would direct attention. Referring first to the gas department, and comparing the figures with those for the corresponding six months of 1906, the gas made showed an increase of 4,298,000 cubic feet; while the quantity sold had increased by 4,106,000 cubic feet, or rather more than 7½ per cent. The amount of coal carbonized was 5830 tons, or an increase of 416 tons; and the average make of gas per ton was 10,822 cubic feet. Of coke, there were 5552 chaldrons made, or an increase of 396 chaldrons; while the quantity sold showed an increase of 300 chaldrons. The average price realized was 9s. 6d. per chaldron, which was 9d. per chaldron more than in the preceding year. The make of sulphate of ammonia was 9 tons more; and the price obtained per ton was 3s. 1d. higher than in 1906. The gas rental during the past six months amounted to £10,753, which was an increase of £779; while the rentals of meters, stoves, and fittings showed an increase of £93. The receipts for residuals were £444 more—due mainly, of course, to the better market for coke. The total receipts of the gas department came to £14,565, which represented a gain of £1318 over the same period of 1906. Turning to the expenditure side of the gas accounts, it would be seen that there was a considerable increase; for while repairs to mains and public lighting were less by some £552, the total expenditure for the half year just closed was more by £868 than in the corresponding period of last year. This increase was chiefly accounted for as follows: Owing to the larger quantity carbonized, the cost of coal was £371 more; repairs to stoves and fittings were £166 more; rates and taxes (which had a marvellous way of rising) were £150 more; and repairs to works came to £604 more, consequent upon the alteration of the system of retorts. The Board had felt it to be the wisest policy to replace the old retort-settings, which had become out of date, by improved ones, with regenerative furnaces, from which they expected to obtain a very considerable economy in fuel and a saving of wear and tear which would soon repay the initial outlay, as well as increase the productive power. For the past half year, the total receipts for gas had been £14,565, and the expenditure £11,283, leaving a profit of £3282—or £450 more than in 1906. With regard to the water portion of the undertaking, the receipts from water rates during the past six months had been £16,647, or an increase of £990; but the expenditure was £1435 more, owing to the following reasons: Pumping charges, due to the much larger quantity of water pumped, were £404 more; wages were £270 more; rates and taxes were £420 more; maintenance of mains was £155 more; and there was £643, which was the cost of the parliamentary opposition to certain portions of the Metropolitan Water Board Bill. He thought they were to be congratulated upon the success of this opposition, as, had the Bill become law in its original form, the Company certainly might have suffered. The total profit on the gas and water portions of the business together for the half year was £11,964, from which had to be deducted interest and income-tax amounting to £2079, leaving a net profit of £9885. The sum required to pay the dividends which the Board recommended was £9434, which would leave £451 to be carried forward to the balance in hand. It was interesting to know that during the past six months the length of the gas-mains had been increased by 356 yards, and of the water-mains by 3334 yards—being a total increase of 3690 yards. The amount of water pumped into the district in the six months was 305,663,000 gallons, which was 45,519,000 gallons more than in the corresponding half of 1906. There were laid on 143 new services for gas and 336 for water. As he mentioned at the meeting six months ago, the work they had carried out at East Barnet had resulted in a largely enhanced supply of water; and the Board were at present engaged in efforts to still further augment the supply, which gave promise of being very successful. This was being done with a view of providing against every possible contingency.

Mr. Alfred Lass, F.C.A., seconded the resolution.

Mr. W. Ormandy asked what was the depth of the deepest well, and whether they were continuing to sink wells.

Mr. T. H. Martin (the Engineer and Manager) said the depth of the deepest well was about 250 feet; but there were, of course, borings below that, to about 500 feet. They were still sinking other wells, and would have to continue doing so, in consequence of the growth of the district.

Mr. Kain inquired whether there was any further prospect of litigation with the Water Board.

The Chairman said there was not. That was all over.

Mr. Kain asked whether the wells were located by the Company's own Engineer.

Mr. Martin, in reply, said they were not. He was not a geologist. Before sinking wells, the Company always took the best geological advice as to where they should go.

The resolution was then carried unanimously.

The Chairman then moved, and Mr. Frederick Lennard seconded, the payment of a dividend, less income-tax, for the half year to June 30 at the rate of 7½ per cent. per annum on the "A" and "C" stocks, 6½

per cent. per annum on the "B" stock; and 5¼ per cent. per annum on the "D" capital gas and water stocks.

Mr. SAMUEL SPENCER asked whether the excessive price of coal would be likely to interfere with the profits in the next half year.

Mr. MARTIN replied that they made their contract very early in the year, and did not suffer very much.

The proposition was then agreed to.

Mr. A. F. PHILLIPS remarked that the Company were served by a very excellent staff of officers, to whom they were much indebted. These were Mr. Martin, the Engineer, Mr. Drew, the Secretary, and Mr. Wright, who had charge of the rental department. Their anxieties during the past six months had not been less than in previous years; and he thought the balance-sheet showed they had been successful in their work. He had much pleasure in proposing a vote of thanks to them.

Mr. J. L. CHAPMAN said, as having some considerable knowledge of gas making and other engineering matters, he felt that their officers had been very successful; and their excellent work deserved acknowledgment. He therefore wished to second the motion.

The vote was accorded; and Mr. MARTIN, Mr. DREW, and Mr. WRIGHT all briefly returned thanks.

On the proposition of Mr. SAMUEL CUTLER, seconded by Mr. SPENCER, a similar compliment was paid to the Chairman and Directors; and with the CHAIRMAN'S acknowledgment, the proceedings terminated.

RIVAL GAS SUPPLIES AT DRAYCOTT.

The following remarks with regard to the gas supply of Draycott were contained in an article published in last Saturday's edition of the "Nottingham Daily Express."

An unusual, and in some respects amusing state of affairs exists at Draycott and the adjacent village of Breaston in connection with the supply of gas. Some thirty years ago, the Long Eaton Gas Company was formed, and obtained parliamentary powers to supply a somewhat extensive area, of which Long Eaton is only a comparatively small portion. No steps were taken to supply the remaining portion of this area (which includes Draycott and Breaston); and when, twenty years ago, a Gas Company was formed at Draycott, the new Company were permitted (without opposition from Long Eaton) to obtain powers to supply Breaston as well as Draycott, which they have done. Unlike many small gas concerns, the Draycott Company have supplied gas at a very reasonable figure, ranging from 2s. 6d. per 1000 cubic feet down to 1s. 6d. for gas-engines—indeed, their average price for gas has probably been the lowest in the county. This summer the Long Eaton Company have laid a 12-inch main through Breaston to Draycott, a distance of some 3 or 4 miles. They undersold the Draycott Company by offering gas at 2s. per 1000 cubic feet; and as an additional inducement, they volunteered to supply customers with free fittings. Thereupon the Draycott Gas Company reduced their maximum charge to 2s.

Such, briefly, are the events which have led up to the present situation. The results are not what one would have anticipated. Instead of Breaston and Draycott consumers expressing satisfaction at the reduction of the charge for gas, there is a very general feeling of resentment against the newcomers. Manufacturers, tradesmen, and private residents alike profess to see an ulterior motive behind the apparent concessions. They point to the fact that the price of gas in Long Eaton is 3s., less 10 per cent., and ask: "Why should the Long Eaton Company spend thousands of pounds in order to supply us with gas at a much lower figure than they charge at Long Eaton?" Not a few answer the question themselves by declaring that it is the intention of Long Eaton to crush the Draycott Company by continually underselling them. Indeed, it is alleged that a representative of the Long Eaton Company bluntly declared that, as there was not room for two Companies in Draycott and Breaston, one must go to the wall.

A prominent resident of Breaston, and a considerable owner of house and cottage property in the village, thus expressed himself to our representative: "I do not think Long Eaton will succeed in their assumed object. We have been treated well by Draycott, who have given us good gas at a fair price. Then we look at it in this way: If the Draycott Company were 'snuffed out,' the Long Eaton Company, to recoup themselves for their outlay, would probably put the price of gas up to about 4s.; for they have power to charge this district 1s. more than in Long Eaton. I do not think many here would pay the price." Continuing, he said that, as far as his tenants were concerned, he did not think any of them wished to be connected with the Long Eaton main; but even if they did, he, as the landlord, would not allow the connection to be made.

In Long Eaton itself the facts of the matter do not appear to be generally known; but, on being interviewed, several of the larger consumers considered they had just cause for complaint. They argue in this fashion: "If 3s., less 10 per cent., is a fair price to pay, leaving a reasonable margin of profit, then a considerable loss must be incurred by supplying Breaston and Draycott consumers at 2s.—a loss which sooner or later either we or the shareholders will have to pay for. On the other hand, if gas can be taken several miles away and profitably sold at 2s., then we in Long Eaton must be terribly overcharged." As for the shareholders, we understand that many of them complain that this extension was carried out, not only without their sanction, but without their knowledge; and they view the very considerable capital expenditure with misgiving, fearing that it will prove unremunerative. Already a special meeting of shareholders has been arranged for the purpose of increasing the subscribed capital of the Company; and we hear that a certain section of the shareholders propose to convene a meeting with the object of having the present results and future prospects of what they term an ill-advised extension thoroughly discussed.

Failure of Electricity at Colchester.—An accident at the electricity works last Friday caused a failure of the current which for half-an-hour left Colchester in darkness. The breakdown occurred just before eight o'clock. The trams ceased running, the cars being left in the streets where they happened to be when the current failed; and many of the shops and houses were in darkness. In recording the incident, the "East Anglian Times" remarks that the fact that the employees at the electric light works had to borrow a candle from a neighbouring hotel, constituted a distinctly humorous feature of the situation.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 620.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.. . . .	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Aug. 29	14	Bournemouth Gas and Water 10 p.c. . .	27—28*	+1	5 0 0
51,810	10	,,	7	Do. B 7 p.c. .	16¼—16¾*	+1	4 3 7
53,200	10	,,	6	Do. Pref. 6 p.c.	14½—15½*	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	245—250	..	5 0 0
300,000	,,	,,	9½	Do. New . . .	185—190	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref. .	115—120	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb. .	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c. .	116—119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c. .	87—90	..	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	26—27	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord. . .	106½—108½	..	4 12 2
1,443,280	Stk.	,, 29	$5\frac{2}{10}$	Commercial 4 p.c Stk.. .	101—106*	+½	4 18 1
560,000	,,	,,	5	Do. 3½ p.c. do. .	98—103*	+½	4 17 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk. . .	123—125	..	4 8 0
55,000	,,	—	4	Do. Deb. Stk. . . .	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd. . . .	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17½—18½	..	4 17 4
15,182,590	Stk.	Aug. 15	$4\frac{4}{10}$	Gas-light and Coke 4 p.c. Ord. . .	93—95	+1	4 12 7
2,600,000	,,	,,	3½	Do. 3½ p.c. max. . .	86—88	..	3 19 7
3,799,735	,,	,,	4	Do. 4 p.c. Con. Pref.	102—105	..	3 16 2
4,193,975	,,	June 13	3	Do. 3 p.c. Con. Deb.	81—83	−1	3 12 3
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental .	174—176	+1	4 10 11
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93	..	3 15 3
195,2.2	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c. .	110—120*	+3	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A . .	217—219*	..	4 11 4
718,100	,,	,,	7	Do. B . .	160½-161½*	..	4 6 8
152,736	Stk.	Feb. 14	7⅝	Maidstone 5 p.c. . .	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb..	100—102	..	4 18 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	107—108	..	4 5 7
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19—20*	..	5 0 0
55,940	10	,,	7	Do. 7 p.c.	12½—13½	..	5 3 8
300,000	Stk.	Apl. 26	8	Oriental, Ltd. . . .	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd. . .	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord. . . .	6¾—7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref. .	4⅞—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb. .	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord. . . .	13—13½	+¼	5 18 6
312,650	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd. . . .	13—13½	+¼	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb. .	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	246—248	..	4 0 8
209,984	,,	,,	10	Do. B	246—248	..	4 0 8
523,500	,,	,,	10	Do. C	246—248	..	4 0 8
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	118—121	+½	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159—161	..	4 19 5
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	115—118	..	4 13 3
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	117—120	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord. . .	105—110	..	4 10 11
120,000	Stk.	Aug. 15	6¾	Tottenham and Edmonton A 5 p.c. .	120—123	..	5 9 9
398,940	,,	,,	5¼	Do. B 3½ p.c. .	100—103	+2	5 1 11
149,470	,,	June 27	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107—109*	+2½	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c. . .	—	..	—
255,636	,,	Aug. 15	6½	Do. B 3½ p.c. . .	128—133	..	4 17 9
75,000	,,	,,	5⅜	Do. C 3½ p.c. . .	—	..	—
80,075	,,	June 27	3	Do. 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord. .	101—104	+2	4 18 6
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	118—120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div."

THE GASHOLDER QUESTION AT ELGIN.

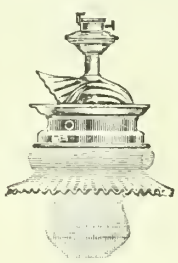
Gas affairs in Elgin again require some attention. The Town Council met yesterday week, when the Town Clerk reported regarding the inquiry before Sheriff Wilson as to the site of the proposed gasholder (*ante*, p. 581), and stated that it had been agreed, in terms of a suggestion by the Sheriff, that a conference be held with the objectors. The conference took place last Wednesday, in the Burgh Court House—Provost Christie presiding. The Provost gave a narrative of the proceedings which led up to their choosing the site at North Lodge, where they owned land which they acquired when they erected the common lodging-house. The Council, he said, had not been able to find a better site than the proposed one. It was surrounded mostly by gardens. There were in the neighbourhood various works; and the narrow lane was never likely to be used for dwelling-houses. He admitted that a few houses would have their views obstructed, particularly that of Dr. Mackay; but wherever they would propose to place the holder, somebody would object. The Town Clerk read letters from Mr. John Munro, objecting strongly to any extension of the works on Lossie Green. Mr. E. D. Jameson, Solicitor, on behalf of the objectors, thanked the Council for agreeing to meet them as suggested by the Court; and he hoped that the result of their meeting would remove the difficulties they were face to face with. The objectors were quite alive to the many difficulties the Town Council had to contend with; but they did not think the difficulties were insuperable. One point which should be kept carefully in view was the present leakage of gas; and in connection with this matter he did not think their friend the Gas Manager was in any way responsible. He had only been a few years in his present position; and this had been going on for many years. In fact, years ago it had drawn comment from the Auditor. It was well known that the whole system of piping was in a sadly deficient state, with the exception of pipes which the Council had relaid or repaired. The leakage was not equalled in any town in Scotland. A wastage of 21 per cent. was a state of matters which should not be allowed to continue. He estimated the annual loss to the town by leakage at £1000; and if this matter were properly attended to by the Council, he believed they would get over all their difficulty for the present, and it would give them time for consideration and negotiation. This brought him to his first point—that the present proposals of the Council were unnecessary. They appeared to the objectors to be a little extravagant. They were rushing from one extreme to the other. At the present time, their storage capacity was only 80,000 cubic feet; and they now proposed to make it 280,000 cubic feet. This surely on the face of it required a little more consideration. It seemed a pity that the Council should embark on a retrograde policy, and depreciate a neighbourhood, which had been greatly improved within the past few years. They were not there without being prepared to suggest a remedy. Of course, if the gasholder were not put where it was proposed, the only other site was Lossie Green, unless they removed the gas-works altogether. There was no doubt that was the ideal policy to adopt; and, in doing so, if they kept in view the large saving which might be judiciously effected in connection with the present excessive waste of gas, this sum alone would go a long way to help towards the better policy of removing the works. Apart from this, however, they thought the Lossie Green site should be adopted in preference to the North Lodge site. The legal difficulty that the green was held for public recreation ground was not insuperable. An application for a Provisional Order to acquire a small piece of ground there would, he had no doubt, be successful. Apart from this, if they adopted the policy of doing away with the Gas Manager's house and the small holder, they would have sufficient room inside the present works to erect a holder with a storage capacity of 160,000 cubic feet, which, with the present one, would give a total capacity of 240,000 cubic feet, or three times the present storage. The Provost pointed out that Mr. Jameson took the whole of the waste gas into consideration; but it was well known they could not carry on a gas undertaking without a certain amount of loss. The lowest waste in a town the size of Elgin was about 10 per cent. If the holder for the proposed capacity were erected inside the works, its height would be 80 feet. Mr. Jameson produced an estimate from a firm of builders in which the height was stated to be only 60 feet. With regard to the leakage, he said that if they only took half, and not the whole, of it, into consideration, it would greatly help them. After discussion, Provost Christie said the Council would meet and give very careful consideration to the suggestions which had been made. The Town Clerk and Mr. Jameson were authorized to draw up a minute to Sheriff Wilson asking him to defer his judgment in the matter. A man from Aberdeen has been selected by the Committee for finding out gas leaks and testing meters.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

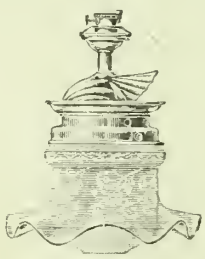
Saturday.

The accounts of the gas department of the Corporation of Aberdeen for the year ending July 31 have been issued. They show a total revenue of £112,747—an increase of £123 over the previous year. Gas and meter rents amounted to £89,528; made up of £73,989 from ordinary consumers; £6261 from motive power; £9251 through prepayment meters; and from meter-rents, £27. The total revenue from gas was £635 less than in the preceding year, due to a reduction in the price of gas last year by 2d. per 1000 cubic feet. There was realized from residual products £20,597, compared with £20,467; from house services, £1100, against £1328; from gas-stoves, £1388, compared with £553; and from rents and feu-duties, £129, as compared with £104. The total revenue was £124 greater than in the previous year, and £313 more than in 1905. The expenditure amounted to £92,950, the principal item of which was coal, which cost £54,925, as against £51,376. Purifying materials (less £200 received for waste lime and spent oxide) cost £1891; salaries and wages amounted to £12,841;


No. 2.

The "BLAND" Light

The Most Efficient and Economical Burner on the Market.


No. 6.

MR. J. D. ASHWORTH, Engineer and General Manager, **PORTSMOUTH GAS COMPANY,** writes:—

"... *My Company have fixed upwards of 3000 of these Burners in this town during the past year. ... I can strongly recommend them to Gas Lighting Engineers.*"

Recent Tests give an Illuminating Result of

32·4 Candles per Cubic Foot.

No. 8.

New Gas Regulating Nipple, with **SIDE** adjustment, fitted to all Burners.
(No extra charge.)
Mantle unaffected by vibration, and fitted with **UNIVERSAL RING.**
NO Lighting Back. **NO** Dirty Fittings or Ceilings.

BLAND & CO., LONDON AND MANCHESTER.

Head Office: 63, QUEEN VICTORIA STREET, LONDON, E.C.
Manchester Office: 20, FENNEL STREET, OFF CORPORATION STREET.

BIJOU.

maintenance of works, £684, and of plant, £3950. The total cost of the manufacture of gas was £74,830, as compared with £73,346. The distribution of gas, including wages of meter inspectors, cost £1575; repairing and refixing meters, £1030; and repairs and maintenance of main and service pipes (laying, paving, and labour, £990), amounted to £3596, as compared with £3718. House services cost £962, as against £1140; and gas-stoves (in respect of which £779 was written off for depreciation) cost £1388, as compared with £553. Rents, rates, and taxes amounted to £5588, as against £6486; management cost £1949, as compared with £1891; general charges amounted to £892, as compared with £780; and discounts and bad debts to £3743; as compared with £3719. The total expenditure was £913 greater than in the previous year. The net profit for the year was £19,795, compared with £20,585 the previous year, and £19,736 in 1905. Out of the net profit there fell to be paid —annuities, £4137; interest on mortgages, bank account, reserve fund, £4518; to be placed to sinking fund for the redemption of mortgages, £9780; for redemption of gas annuities, £650; and to reserve and insurance funds, £300; leaving a balance of £6386 to be carried to the current year's account. Capital expenditure during the year amounted to £3320, raising the capital account, with funds and stocks on hand, to £374,842. The quantity of coal carbonized was 70,010 tons; and the average price of it was 15s. 5½d. per ton. The quantity carbonized the previous year was 68,414 tons. Gas made amounted to 725,301,000 cubic feet, as compared with 691,306,000 cubic feet. Gas sold amounted to 690,265,000 cubic feet, an increase of 34,094,000 cubic feet. Gas unaccounted for amounted to 35,036,000 cubic feet, equal to 4·83 per cent., as compared with 5·08 per cent. the previous year. The average yield or gas per ton of coal was 10,211 cubic feet. The prices of gas were 2s. 7d. for lighting, and 2s. 4d. for power. Bad debts amounted to £334. The Gas and Electricity Committee met yesterday and approved of the accounts. They also adopted estimates for the current year, according to which the revenue is expected to be £114,528, and the expenditure £122,670. The greatly increased price of coal—now 18s. 2d. per ton—will entail an extra outlay equal to 3d. per 1000 cubic feet; but the Committee resolved to recommend that the prices of gas should remain unchanged for this year.

In the Greenock Town Council last week, it was reported that the quantity of gas sold during the previous month amounted to 14,616,000 cubic feet—a decrease of 124,000 cubic feet as compared with the corresponding month of last year. The average yield per ton of coal was 9602 cubic feet. The quantity of coal used was 1497 tons, as against 1231 tons. Mr. Forbes, in moving the adoption of the minutes of the Gas Committee, said it appeared that less gas had been made per ton of coal than was made in the same period of last year, but this was due to the erratic working of the station meter. They were also being credited with a larger amount of leakage than there actually was. It was proposed to hold an exhibition of gas appliances, and that the gas department should bear the cost of the exhibition. Bailie Bennett moved an amendment to the proposal to bear the cost of the exhibition. They were all agreed, he said, that every effort should be made to increase the sale of gas-cookers and similar appliances, but he thought it ought to be done on business lines. In a discussion which followed, it was stated that local tradesmen would be asked to take part in the exhibition, that heating and lighting appliances would be exhibited by them, but that, if they wished, they could exhibit cookers. On a division, the minutes were adopted by 19 votes to 5.

Before the advent of the cinematograph for the illustration of passing events, the high-water mark in the world of pictorial illustration was the dissolving view, in which the one still view melted into the other. This dissolving view—some might call it the chamelion view—is well exemplified by the position of Treasurer Young, of Musselburgh, at the present time. The Town Council, of which, of course, Mr. Young is a member, welcomed to the town one of those all-absorbing, thoroughly unselfish companies vending electricity for power and lighting. They allowed one of these companies to run a tramway into the town, and to take over the lighting of some of the streets of the burgh. The Company, not so great philanthropists after all as certain wide-o'-gapes imagined, wanted to earn aid vidend on their outlay. They could not squeeze the Corporation, and so the trouble they have had has been with their employees on the tramway system. A strike of these employees has been in existence for several weeks now, upon the question of payment for extra hours. One of the most prominent supporters of the strikers has been Treasurer Young, who has been instant, in season and out of season —even to addressing open-air meetings—in support of their cause. At one of these open-air meetings the other night, Mr. Young, in support of an argument in favour of the strikers, urged the electors of the town to return to the Town Council men who would be pledged to revert from electricity to gas for public lighting, at the end of the two years' contract. If they did so, he said, they could acquire the tramway and the lighting concern for an old song. He would be the last to advocate returning to gas from electric light, but the Company [the Electric Company] he declared had been so unreasonable that he was prepared to make any sacrifice necessary to defeat them. I am not desirous of entering into a discussion upon the ethics of municipal finance in Musselburgh; but it lies upon the surface of the question that when the Corporation entered into the bargain with the Electric Company, their desire was to get below the local Gas Company in the matter of lighting. That they have not altogether succeeded is apparent; but the blindness of at least one of their number is made manifest by his remark about "sacrifice" in returning to gas lighting. If he knew what he was talking about, instead of "sacrifice" he would speak of "profit" in returning to gas lighting; but then the colour of the coat of certain public men must be made to suit their environment, other considerations being left out.

It is announced that owing to the largely increased demand for gas at Ecclefechan, it has been found necessary to duplicate the entire plant at the gas-works, and that it is anticipated that the work will be completed by the end of September. The gas-works are private property, and the gas supplied is produced by one of the processes which are worked with some of the lighter oils.

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CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Aug.* 31.

Improved demand has been sustained all through the week, and supplies have been absorbed as they have become available; but there has been no decided improvement in values, though in urgent cases extreme prices have been paid. The closing quotations are £11 16s. 3d. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has been more doing in the forward position, but the extreme firmness of the large makers tends to check business. For September-December delivery £12 per ton f.o.b. Liverpool has been paid, and £12 2s. 6d. per ton, f.o.b. Leith, for November-April; and at the close an advance of 2s. 6d. per ton on these prices is being quoted.

Nitrate of Soda.

This market remains without alteration—quiet but steady. Spot prices are 11s. 1½d. per cwt. for 95 per cent., and 11s. 4½d. for refined quality.

Tar Products. LONDON, *Sept.* 2.

Markets are still quiet, and prices fairly steady. In pitch, there is decidedly more disposition among manufacturers to reduce their prices to the level of dealers' ideas for delivery during the present year. On the east coast 26s. 6d. has been accepted to the end of the year; while from ports where high rates of freight obtain, distillers have offered their make at this figure without success. Manchester and Liverpool makers appear to be rather better sold, and refuse to make offers; while the west coast generally are fairly firm in their ideas. Continental buyers are still holding off. South Wales are declining nearly all business for this year's delivery, and report having bought very cheaply all over 1908. Creosote is very steady. The large London makers decline to sell in most cases; but some business has been done at 2¾d. to 2⅞d. The Midlands are very firm, and quote from 3d. to 3⅛d.; while in the North, makers are asking from 2⅝d. to 2⅞d., according to quality and place of delivery. Benzol 90 per cent., benzol 50-90 per cent., and toluol are all very quiet, and business is still reported at low figures. For delivery all over 1908, 90 per cent. has been sold at very little over prompt prices. Solvent naphtha is quiet in the country, but fairly steady in London, where London makes are still in fair demand. Carbolic is steady, though Continental manufacturers refuse to bid more than 1s. 8d., east coast; but dealers are paying rather over this to the manufacturers. Crystals are quiet, with little business doing. Salts are in good demand at fair prices.

The average values during the week were: Tar, 15s. 3d. to 19s. 6d. Pitch, London, 26s. nominal; east coast, 25s. 6d. to 25s. 9d.; west coast, 24s. to 25s. Benzol, 90 per cent., 8d. to 8½d.; 50-90 per cent., 8½d. to 9¼d. Toluol, 10½d. to 11½d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. 0½d. to 1s. 2½d.; heavy naphtha, 1s. 0½d. to 1s. 2d. Creosote, London, 2⅞d.; North, 2⅝d. to 2¾d. Heavy oils, 3d. to 3¼d. Carbolic acid, 60 per cent., 1s. 8¼d. Naphthalene, £6 10s. to £12 10s.; salts, 35s. to 40s. Anthracene, "A" quality, 1½d. to 1⅝d.

Sulphate of Ammonia.

This article remains steady, but dealers still decline to improve their bids, and are evidently filling their requirements at the existing figures. The principal London Gas Companies are well sold, and their quotations are rather above the market. Ordinary makes are fetching about £11 11s. 3d. to £11 12s. 6d. on Beckton terms, and £11 16s. 3d. to £11 17s. 6d. f.a.s. terms. In Leith, ruling figures are about £12 for prompt, and £12 2s. 6d. for forward delivery, though in most cases makers are asking 2s. 6d. over these figures. Hull is quiet at £11 13s. 9d. to £11 15s.; and Liverpool is steady at £11 16s. 3d. to £11 17s. 6d.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Beginning with yesterday, the prices of house fuel and slack were officially advanced; the former 1d. per cwt., or 1s. 8d. per ton, and the latter 10d. per ton. The state of trade fully warrants this advance. All through the summer both home and foreign demands have been far above the average. All new contracts are dearer, and there is no prospect of relief to consumers. In June, 1906, the coal exported from this country totalled 4,265,817 tons; in July of the same year, the quantity was 5,027,162 tons. Last June the figures were 5,321,093 tons, and in July 6,098,663 tons. In consequence of these increased exports, coupled with the rise in prices, passenger rates on outward bound steamers are being advanced. Average quotations on the Manchester Coal Exchange are as follows: Best house coal 16s. to 17s. 2d., secondary 14s. to 15s., common 12s. to 14s., burgy 10s. 6d. to 11s. 2d., best slack 9s. 6d. to 10s. 4d., medium 8s. 6d. to 9s., lower qualities 7s. 9d. to 8s. 4d. Coal for export is 13s. to 14s. 6d. Furnace coke 18s. to 24s.

Northern Coal Trade.

There is a very strong demand for coals, the exports being heavy and the home consumption showing an increase, while the tendency of prices is now again upwards. In the steam coal trade, there is some pressure, which is likely to increase as the time draws near for the end of the Baltic trade. Best Northumbrian steam coals are 16s. 6d. to 16s. 9d. per ton f.o.b. For second-class steams, the quotation is from 15s. 9d. to 16s., and steam smalls are from 10s. to 10s. 6d.; the latter kind being rather more abundant. In the gas coal trade, the demand is now increasing for home use, and there are also heavy foreign shipments; so that the production is well taken up, and there is some scarcity of the best classes of coal for prompt shipment.

R R

RICHMOND'S COOKER.

AT HOME: EVERY DAY.

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ADVERTISEMENT OF THE RICHMOND GAS STOVE AND METER CO., LTD., WARRINGTON, LONDON, STRATFORD, AND BRANCHES.

Durham gas coals vary from about 14s. to 15s. 6d. per ton f.o.b., with 3d. per ton more for the best kinds. In contracts, the quantities are not heavy; but where the delivery is over the winter, the prices are very high—in one or two instances higher than for half-a-dozen years. At the same time, it is believed that some second-class gas coals have been sold, for delivery over next year, at about 12s. 10½d. per ton f.o.b. —the quantity being given at about 40,000 tons. Coke is very firm, generally, and gas coke is steady, even with the larger production that is now made. Good gas coke is from 19s. 6d. to 20s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Trade continues very active, and the cry of the market is still that the increased prices come, but those who discern believe that the tide is on the turn. The high figures ruling here are leading to larger productions in foreign pits, and the high wages earned in pits at home are attracting shoals of labour. This will soon lead to larger outputs, after which prices will come down. A leading authority has given out that the present high prices will not live beyond a few months. The quotations are: Ell 14s. 6d. to 16s. 6d. per ton f.o.b. Glasgow, splint 14s. 6d. to 15s., and steam 13s. 6d. to 13s. 9d. The shipments for the week amounted to 340,050 tons—an increase of 31,527 tons upon the previous week, but a decrease of 29,136 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,436,458 tons—an increase of 589,766 tons upon the corresponding period of 1906.

Sale of the Bridgend Electric Power Station.

At the meeting of the Bridgend District Council last Tuesday, the Chairman (Mr. R. C. Griffiths) made a statement regarding the negotiations which have been proceeding for some time between the Council and the South Wales Electrical Power Distribution Company, Limited, for the purchase by the Council of the Company's generating station at Bridgend. Reviewing the negotiations, Mr. Griffiths stated that first of all the Council entered into an agreement with the Company indemnifying them against any loss sustained in continuing to work the station, which had cost no less than £38,700 to erect and equip; and the Council had now agreed to purchase it for £5000. They had also secured favourable terms from the ground landlord for a reduced rent; and the Committee of the Glamorgan County Asylums, who were the largest consumers of power from the station, had agreed to take energy for lighting at 3d. per unit, and for power purposes at 1½d., against 1⅜d. paid to the Company. The Council were advised that £1500 would be sufficient to provide the necessary stock-in-trade; and an application was being made to the Local Government Board for permission to borrow £6500. In this was included the estimated cost of obtaining a Provisional Order for supplying the extended area of the Bridgend district and the asylums.

Hereford Ironmongers and Gas-Fitters and the Gas Committee.—A short time ago the Gas Committee of the Hereford Town Council issued a circular to householders in the city notifying their willingness to undertake the maintenance of consumers' incandescent gas-lights. Thereupon a memorial was drawn up, signed by twelve of the principal ironmongers, plumbers, and gas-fitters, and presented to the Council, pointing out that the new departure was a serious attack upon the tradesmen of the town supplying gas-fittings and accessories, inasmuch as it set up unjustifiable competition with them as ratepayers. The matter came before the Town Council on the 6th ult., and was referred to the Gas Committee (see *ante*, p. 456). Their report has not been officially made public; but the "Ironmonger" says it is understood that, in deference to the representations made, the scheme will be abandoned.

New Joint-Stock Companies.—The Thurles Gas Company, Limited, has been registered with a capital of £7000, in £1 shares, to acquire and continue the business of gas manufacturers, now carried on by Messrs. Robert Bruce Anderson and George William Anderson, in Thurles, Co. Tipperary, under the title of the Thurles Gas Company. The Longwith Bye-Product Company, Limited, with a capital of £41,000, in £100 shares (400 being participating preference shares), is to adopt agreements (1) with the Sheepbridge Coal and Iron Company, Limited, and (2) with the Power Gas Corporation, Limited, to acquire land, and erect thereon gas-producer plant, bye-products recovery and chemical works, &c. There will be no initial public issue. The Neilston Gaslight Company, Limited, was registered in Edinburgh last week, to take over an existing private Company. The capital is £4000, in £1 shares, for which the public are not invited to subscribe. The Lighting and Heating Trust Company, Limited, has been registered with a capital of £10,000, in £1 shares, to carry on, assist in, and promote lighting, heating, and other industries and undertakings, hold, deal in, and convert shares and securities, and for similar purposes. There will be no initial public issue.

Coal in Kent.—At the statutory general meeting of the East Kent Colliery Company last Wednesday, the Chairman (Mr. Arthur Burr) said it was only in March last that the Tilmanstone Colliery came into the possession of the Company. He asked Mr. Griffith, their certificated Manager, to carry the pit as deep as could be done consistent with safety, before stopping to do the necessary bricking up. At 707 feet progress was suspended in order to brick up to a depth of 500 feet. By Saturday, or Monday at the latest, this work would be completed and the sinking resumed. Knowing the character of the strata to be passed through, he felt quite comfortable as to the future. By January or February next they would be down to 1150 or 1250 feet into the first seam of coal; and they would then comply with the request of their critics to put coal of a high quality on the bank of the colliery. He had always felt convinced that when they reached this stage in their operations, no difficulty would be found in obtaining all the capital wanted for carrying on developments in the south-east of England as fast as labour and machinery could do the work. Mr. G. Humphrey, in seconding the motion for the adoption of the report, said that, from what he saw during a visit to the property, he was fully convinced that the statements of the Manager would be borne out by results in the near future.

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RADFORD METER WORKS
NOTTINGHAM.

Suicide by Gas.—Thomas Parrott, aged 78, a manufacturing confectioner, of Poole, was found dead in bed last Saturday week, asphyxiated by gas; and the Coroner's Jury who investigated the occurrence returned a verdict to the effect that deceased died from inhaling coal gas while temporarily insane. It was stated that he was greatly worried about business matters; and that when found, one end of an india-rubber tube was near his mouth, and the other end was fitted to a gas-tap which was turned full on.

Price of Gas at Wisbech.—The report adopted at the half-yearly meeting of the Wisbech Lighting Company stated that, in consequence of the improvements which had been recently made in the plant at the Company's works, and the economies thus effected in management, the Directors were enabled to further reduce the price of gas to the consumers. The price to be charged from July 1 last would be 3s. per 1000 cubic feet net for ordinary purposes, and for users of motive power 2s. 9d. per 1000 cubic feet net.

Ottoman Gas Company, Limited.—At the half-yearly meeting of the Company next Tuesday, the Directors will report that the gas-rental for the six months ending June 30 amounted to £14,802, whereas for the corresponding period of last year it was £13,260. The net profit is £3187, against £2991 for the first six months of 1906. The amount standing at the credit of the profit and loss account is £9422. The Directors recommend the payment of a dividend at the rate of 7 per cent. per annum on the preference shares, less income-tax, and at the same rate on the ordinary shares, tax free; leaving a balance of £6823 13s. 10d. to be carried forward.

The Gas-Works for Santa Cruz.—With reference to the paragraph on this subject which appeared recently (see *ante*, p. 519), we learn from the report of Mr. J. E. Croker, the British Consul at Teneriffe, that to carry out the contract a limited Company was formed in Bremen, with a capital of £42,500, consisting of 500 ordinary and 350 preference shares of 1000 marks each. The concessionary rights were transferred to this Company, who afterwards placed in the hands of the original holder of the concession the order for the erection of the works. This began in February last, and will be completed, it is believed, by the end of the year.

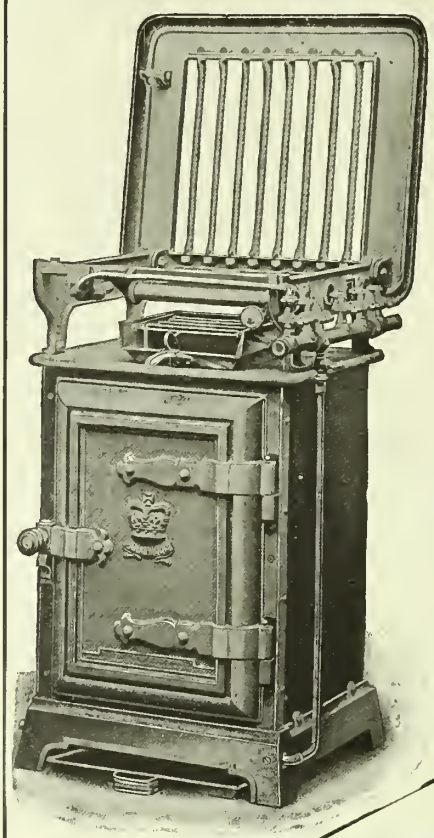
Stealing from Gas-Meters at Wallsend.—At the Wallsend Petty Sessions a short time ago, James Anderson, 27, a labourer, of no fixed abode, was charged with having stolen money from slot gas-meters. Evidence having been given by inspectors of the Walker and Wallsend Union Gas Company as to the meters having been tampered with and pennies extracted, Inspector Pringle stated that the accused had lived by stealing from gas-meters in the town; there having been twenty robberies similar to those with which he had been charged. Accused pleaded guilty, and said he had been "very hungry the last two or three weeks." He was committed to prison for a month on each of two charges—one sentence to follow the other.

Woking Water and Gas Company.—At the half-yearly meeting of the Company yesterday, the Directors reported that the balance at the credit of the profit and loss account for the six months ending the 30th of June was £4528, out of which they recommended the payment of a dividend at the rate of 4½ per cent. per annum, less income-tax, which would absorb £3596, and leave £932 to be carried forward. The revenue amounted to £7967, and the expenditure to £3081; leaving a balance of £4886. During the half year, 131 house and 21 meter connections were made; and in the same period the mains were extended about 6497 yards. Sir John Wolfe-Barry, who was appointed sole Arbitrator for the settlement of the terms of purchase of the saleable portion of the Company's water undertaking within the extended borough of Guildford, awarded, as already mentioned in the "JOURNAL," £46,900 as the price to be paid the Company. The amount has not yet been received; but the Company are informed that application has been made for the Local Government Board's sanction to borrow the required money. The Directors are urging the Guildford Corporation to discharge their liability with the least possible delay.

Tarring of Roads in Kent.—In his third annual report to the Kent County Council upon the maintenance and repair of the rural main roads directly maintained by his department, Mr. H. P. Maybury, the County Surveyor, says that during the year 99,500 gallons of tar were purchased and used in treating the main roads through populous places—all such work being an entirely new charge. Some 53 miles of surface directly maintained by the Council was tar painted at a cost of upwards of £4000, in addition to which contributions have been made for similar work undertaken in urban districts. It may be, he remarks, that this tar-painting work is a preservative to the road; and he hopes some benefit may be derived from it. "As a dustlayer, tar, properly applied, is," he adds, "most effective, and will be largely used in future. The residents in rural districts suffer much more from the dust nuisance than do those in urban areas, because much greater speed is obtained by motors in the former; while in the latter street watering is almost general. The high-speed traffic has a prejudicial effect upon the road surfaces; and as at least 60 per cent. of the cars are now fitted with armoured tyres, much greater damage is caused than formerly."

Conviction for Theft of Gas.—At the Greenwich Police Court last Tuesday, before Mr. Rose, Henry George Ratcliff was charged with stealing a quantity of gas, the property of the South Suburban Gas Company. The accused, a plumber and gas-fitter at one time in the employ of the Company, was caretaker at No. 10, West Hill, Sydenham, from which the gas had been cut off in June last year. On the 17th ult., one of the Company's meter inspectors, accompanied by a detective, visited the house, and found that a connection had been made with the pipe from the main, so that a supply of gas could be obtained for cooking purposes; in fact, a jet of gas was burning at the time. Ratcliff admitted having taken 3000 cubic feet of gas. He said he was very sorry for what he had done; but poverty had caused him to steal the gas. He was willing to pay for what he had taken. Evidence having been given, accused was asked by Mr. Rose what he had to say in answer to the charge. He replied that he was very sorry; and had he not been so hard pushed by poverty he would not have done what he did. His Worship pointed out that he had a trade in his hands, and had misused his knowledge and systematically stolen the gas. He must commit him to prison for six weeks.

"CROWN" COOKER



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(PARKINSON BRANCH),
COTTAGE LANE, CITY ROAD, LONDON.
BELL BARN ROAD, BIRMINGHAM.

At a sale by auction last Wednesday, some original £10 shares in the Hyde Gas Company realized £25 1s. each ; a few new ordinary shares fetching £18 and £18 1s. apiece.

The Directors of the British Gaslight Company, Limited, recommend a dividend at the rate of 10 per cent. per annum, free of income-tax, for the six months ending the 30th of June.

Messrs. T. & E. Wannbacher and Co., of Basinghall Street, E.C., have sent their special catalogue of sluice-valves suitable for water, gas, and steam. It furnishes full particulars in regard to dimensions and prices.

The Carron Company are issuing a neatly-printed pamphlet giving illustrations and particulars of their new gas-heated steam radiators and condensing gas-stoves. The radiators are designed for places where the ordinary stoves or coal fires are not applicable, and are made in three heights.

The Directors of Stewarts and Lloyds, Limited, recommend the payment of dividends at the rate of 6 per cent. per annum on the preference shares, and 9 per cent. per annum on the ordinary shares. The interim dividend on the ordinary shares at this time last year was also at the rate of 9 per cent.

The Richmond Gas Stove and Meter Company, Limited, held last Friday the half-yearly conference of their representatives at their London Offices and Show-Rooms. Mr. H. M. Thornton presided. In the evening, the representatives were entertained at dinner by the Directors of the Company.

The Directors of the Douglas Gas Company announce, in their half-yearly report, that the increase in the cost of coal renders it necessary for them to add 1d. per 1000 cubic feet to the price of gas. They protest against the agitation which has led the Town Council to demand arbitration on the question of the charge made for the public lighting of the town.

In order to meet the increasing demand for the "Bland" inverted burner, Messrs. Bland and Co. advise us that they have opened new offices and show-rooms at 20, Fennel Street, off Corporation Street, Manchester. In London, new offices and warehouse have been opened at 29, Little Trinity Lane, E.C. ; but the show-rooms are still at 63, Queen Victoria Street.

Last Sunday week, there was some excitement at Hull, in consequence of the fusing of an electric light cable in a street-box, by which a shop-front was damaged. The fire brigade was summoned ; but its services were not required, as the current was promptly cut off. The accident resulted in a partial failure of the electric light, by which inconvenience was caused at several places of worship.

As several German makers of gas-engines have now expressed approval of the proposal to establish a combination for this branch, negotiations with this object in view have been resumed. According to the "Ironmonger," a conference on the subject is to be held in the middle of this month, and the hope is entertained that it will then be possible to arrive at some understanding, and to draw up an agreement, which will probably take the form of a price convention.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.
ENGINEER (New Zealand). No. 4825. Applications by Sept. 17.
WORKING MANAGER. No. 4816.
SHOW-ROOM ATTENDANT (Man and Wife). Heywood Gas-Works. Applications by Sept. 17.
SULPHATE MAKER. No. 4828.
GENERAL FITTER. No. 4829.
GAS-FITTER. No. 4830.

Gas Literature Wanted.
L. P. LOWE, 1214, Polk Street, San Francisco.

Situations Wanted.
REPRESENTATIVE (GAS AND WATER). No. 4813.
WORKING MANAGER. No. 4832.

Partnership and Management.
GAS ENGINEER'S BUSINESS. No. 4817.
No. 4831.

Sulphate of Ammonia Plant.
REPAIRS WANTED.

Plant, &c., for Sale.
GAS-LAMPS. No. 4826.

Patent for Sale.
INTENSIFIED GAS-LAMP. No. 4827.

Company Meeting.
OTTOMAN GAS COMPANY. Offices. Sept. 10, One o'clock.

Stocks and Shares.
GREAT YARMOUTH GAS COMPANY. Sept. 26.

TENDERS FOR

Coke.
LEIGH-ON-SEA GAS-WORKS. Tenders by Sept. 17.

Cast-Iron Pipes.
PLYMOUTH CORPORATION WATER-WORKS. Tenders by Sept. 19.

Gas Oil.
ROCHDALE CORPORATION. Tenders by Sept. 18.

Sluice Valves, &c.
PLYMOUTH CORPORATION WATER-WORKS. Tenders by Sept. 19.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

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Water Engineer.
Municipal Buildings,
Plymouth, Aug. 30, 1907.

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W. Carlyle Croasdell,
Clerk to the Council.
Council Offices, Leigh-on-Sea,
Sept. 2, 1907.

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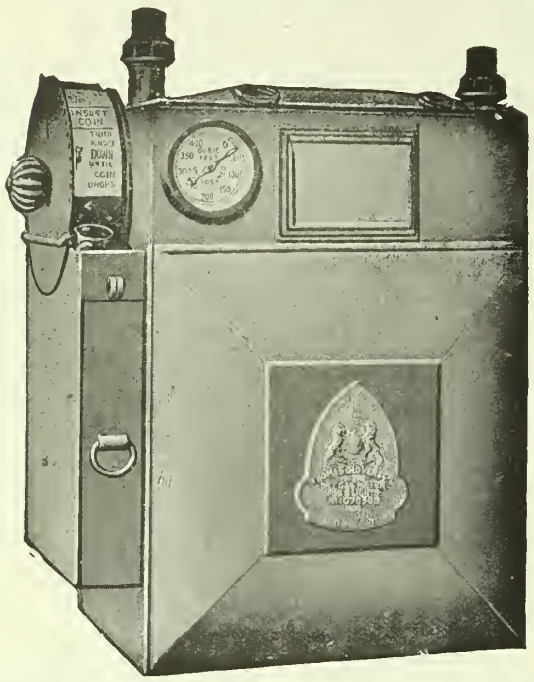

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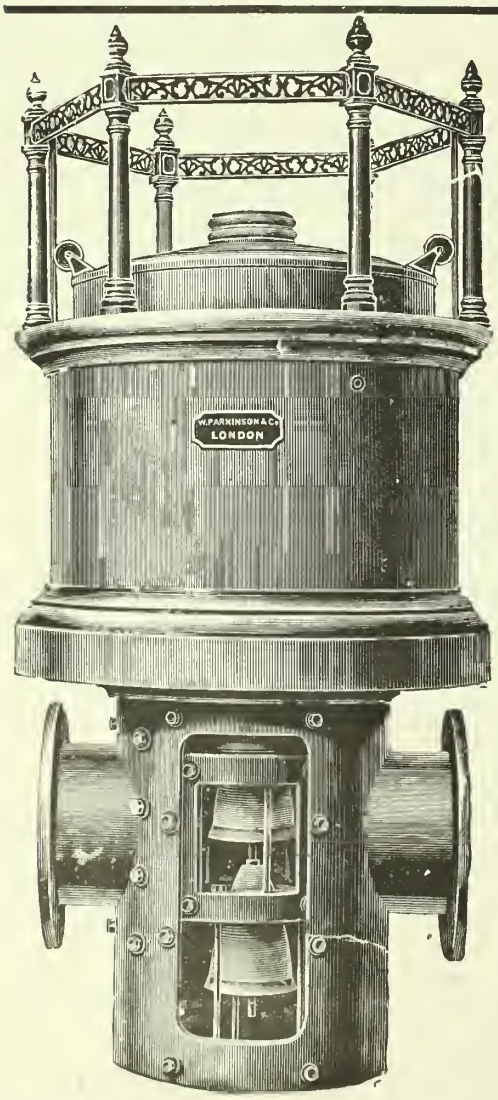

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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VOL. XCIX., No. 2313.—TUESDAY, SEPTEMBER 10, 1907.

EDITORIAL NOTES—GAS, &c.

An Appeal.

IT is with considerable pleasure that we accord prominence to an appeal that Sir George Livesey makes in another column [p. 681] to the gas industry, to annually provide the stipend for the recently founded Professorship of Fuel, Solid and Gaseous, at the Leeds University. The new department commences its work on the 1st prox.; and it will give the greatest possible pleasure to those who have interested themselves in this scheme if, well before that date, the amount of the stipend is permanently assured. The sum required is the modest one of £500 a year. In its provision, the sympathy of the Gaslight and Coke Company, and therefore of the Governor, Mr. Corbet Woodall, has been enlisted; as well as of the Leeds Corporation Gas Committee, the South Metropolitan Gas Company, and (there is little doubt we shall soon be able to add) of the South Suburban Gas Company. Out of this new departure of the Leeds University (which was fully explained on July 16 last, pp. 147, 152), the gas industry—and not unnaturally—will desire to obtain as much prospective benefit as possible through the higher and more comprehensive training of its technical officials. To realize this, the department must be attached to the gas industry and the gas industry to the department with more substantial bonds than the provision the Institution of Gas Engineers has made (valuable as that provision is) for special research work. Sir George suggests the way; and through our columns he makes his appeal, seeing that personal application for money is objectionable to him, as it is not infrequently to the recipients of such personal applications. But we are at liberty to put it to those who would have made ready response to a personal appeal from Sir George to accept his present general appeal as having been individually made to them, and not to delay in responding.

The cause is a good one; it is the provision of a better opportunity for the complete training of the men required in the gas industry than has hitherto been afforded. The invitation to gas undertakings to promise an annual subscription towards this particularly good industrial cause is issued to all gas undertakings. The Leeds Gas Committee have already headed the list with £100; and the same sum is promised annually by the Gaslight and Coke Company and by the South Metropolitan Company. The South Suburban Gas Company, there is reason to think, will be good for £20. Anyway we have here £300 towards the £500 required; so that only £200 a year more has to be raised. But on this point we will presently make a suggestion. Sir George trusts that the Gas Committees of the other Yorkshire towns will follow the example of the Leeds Corporation, and that Gas Companies generally will follow that of the two London Gas Companies. There is no reason why contribution from local authorities should be limited to the Yorkshire gas-works owning towns; the intellectual product of the new department will be available to the whole British gas industry. Respecting the before-mentioned point as to surplus offerings. Sir George proposes that "if a larger sum is "offered than is necessary, the individual subscriptions "shall be reduced proportionately to the business of the "contributors." The offering of subscriptions will show a sympathy and a willingness to contribute; and therefore it may be suggested that, if there is a surplus, it should be allowed to accumulate until—who knows?—a fund may be established, subject to safeguarding conditions, and possibly administered by the Institution of Gas Engineers—which would assure the stipend, and render the gas industry independent of further contribution.

It is not often that Sir George Livesey has personally asked anything of the gas industry. He is doing so now; but it is a small thing that he desires. We hope the list of subscriptions, which we shall be happy to publish in the "JOURNAL," will show that his appeal has not been made in vain.

At the Welsh Meeting.

COMMERCE, manufacture, and the new instruments of offence and defence of the electrical opponent were subjects of prominence at the meeting of the members of the Welsh Association at Shrewsbury on Wednesday last. Mr. E. Jones, of Burslem, is the new President; and his title to the position is that he was one of the founders of the organization, and was until quite recently the Engineer and Manager of the Pontypridd Gas-Works. It was in his Inaugural Address that in many ways commerce and manufacture were dealt with; and it was in a paper by Mr. J. H. Canning that the new lamps of the electrical industry were treated upon. Regarding first the address. If anything, it was somewhat too long; but we must do the President the justice of saying that, extensive as it was, he contrived to put interest into every one of its manifold features. He is an advocate of Commercial Sections in connection with technical gas organizations, with this proviso that they must do nothing to prejudice the technical work of the organizations. We are with him completely in this matter, and really must plead a want of understanding of the antagonism of the few to associated movement and work in connection with the commercial side of gas undertakings. Take the revenue account of a gas undertaking. Look at the items carefully one by one; and then attempt to answer the question, Why should not the commercial work, as well as the technical, be the subject of associated endeavour? The dividing-line between the commercial and technical parts of an undertaking is narrow; and, perhaps unintentionally, the President gives point to this in referring to the cost of coal and then passing direct to the question of carbonization.

There are indications all round that the price of coal will be permanently higher in future than the prices that have ruled of late years; and, this being so, thanks are due to those who have borne the brunt of the battle in making easier the paths of the responsible officials of gas undertakings by breaking down the statutory and unreasonable requirements of high illuminating power and purity, which breaking down has furthermore given a scope to the technical work of carbonization not previously enjoyed by the gas engineer. Whence are we drifting in carbonization? Most men are reserving judgment on this momentous question. The President says: "I have always supported high heats and long "duration charges; and my experience convinces me that, "if we are to cheapen our gas, we shall have to resort more "towards coke-oven principles." There has not been sufficient evidence advanced yet to show that the President's conviction rests on any very sure foundation; and it would have been of interest had he expanded a little more on this, and enunciated the reasons for the conviction. The future of carbonization may be, as he somewhat guardedly expresses himself, "towards" coke-oven principles; but the testimony up to the present leads to the belief that for the gas maker the stop will have to be made long before the existing coke-oven practice is reached. But while we are looking for more imposing things in connection with carbonization, great progress has already been made; and the fruit of the progress is marked in the Burslem carbonizing accounts, which show that whereas with regenerative horizontal settings the cost of carbonization per ton of coal is 3s. 1·5d., with inclined retorts and their auxiliary plant the cost is 1s. 10·1d. per ton. This is satisfactory; but, as already said, there is something to be grateful for in that the Legislature has, through the abatement of requirement, given to gas practitioners even greater scope for effecting progress. Truly, says the President: "Never was our industry in greater need of the dis-"tribution of a low-cost gas than in the present, and no "manager can afford to neglect details, however small his "works."

The President spoke approvingly of retort-house governors, of the Fiddes-Aldridge discharger-charger, as also of the Hastings carburation process for relief from naphthalene troubles; while purification occupied quite a large space in his address. In view of the editorial article in last week's issue on the field for business that heating presents to the gas industry, it is interesting to read the President's remarks

on the subject, and of what he is doing in the way of the hire-purchase of fires. But the address is full of experiences on these and such questions as the competition with electricity, high-pressure distribution, and the waste gases and effluent of sulphate plants. To treat of all these matters here would be to traverse the whole address. The President surveys the gas industry's affairs with evident satisfaction; and it is plain that with him obstacles only arise to be negotiated and conquered. That is as things should be with a manager in the progressive gas industry.

In all businesses, no matter their character, it is the best the competitor can do upon which one's eyes has to be kept. The domestic lighting business in both the gas and the electricity industries is the largest branch; and not by any means insignificant ones are shop and street lighting. For domestic, shop, and side-street lighting, the new metallic filament lamps constitute the best in efficiency, given suitable conditions, that purveyors of electricity can offer; while for main street lighting and the illumination of exteriors of large premises, flame arc lamps are best in the same respect, though not in others. This being so, gas engineers should keep an eye on these particular lamps, which, while they have the one merit in illumination efficiency for the current expended, lack (may we not say ?) all the other merits of the older forms of carbon filament lamps and arc lights. The paper by Mr. Canning gives us a compendious account of these lamps; and what he has to say upon their weak sides is not one whit exaggerated or misrepresented, but, if anything, understated. It is in the compendiousness of the paper that its value is found; for the greater part of what he says about the lamps is, and perhaps in more detail, scattered through our "Electric Lighting Memoranda" the past year or two. Comment has been frequent; and therefore there is not much that is fresh that can be said by us on the paper. It must not, however, be understood by this that Mr. Canning does not present any new points to supplement the value already attributed to the paper. There are several which he has collected by observation and investigation. One of interest and importance is his research into the spectrum of the flame arc light, the result of which research is that he finds the spectrum is not in any sense a continuous one. This is a scientific fact worth knowing as bearing upon the performance of the flame arcs. The performance of these lamps can be regarded, as has been shown oftentimes in the "Journal" and now by Mr. Canning, from many points; and the attention that has been so bestowed upon them has checked the impetuosity with which tradesmen who favour cheap-jack methods of advertising at first ran after the lamps. Claims have been unsubstantiated by time and experience; and whether for street or external shop lighting, their imagined virtues have been largely discounted.

What is true of flame arc lamps is also true of metallic filament lamps. Mr. Canning tells us of their reputed efficiencies, and of their proved defects and unsuitability, from the consumers' point of view. An effective life is ascribed by electricians to these lamps ranging from 600 hours up to a figure that is sufficient to make one stand amazed, until it is recalled to mind that the figure is the result of a test carried out under the comfortable conditions of the laboratory. Mr. Canning has ascertained that the actual life of a "Tantalum" lamp in a shop window where it is exposed to the vibration of traffic is, on an average, 216 hours; while of two "Osram" lamps fixed in series in a similar position, one failed after less than five hours' use. From Chelmsford we learn that during the past year 307 Nernst lamps were installed in the town; the replacements numbered 1978—the life per burner being 572 hours. Considering these figures, and the initial cost of the Nernst and the metallic filament lamps, the expense of renewals must be something enormous. Among the inherent defects of the metallic filaments are their unsuitability for high voltages; but there is persistent work going forward to overcome this. When success has appeared to be within grasp in this respect, a lamentable escape of efficiency has accompanied. There is one point concerning Mr. Canning's comparison as to the running cost of Osram lamps and incandescent gas-burners which indicates his desire to keep on the right side. The Osram lamps are referred to as being of 32-candle power. This should be 32 Hefner units. The lamps therefore at their best are only of between 28 and 29 candle power; and the difference on the two lamps is consequently about 6 candles. The cumulative effect of such a difference is not to be despised or disregarded. On the other hand, Mr. Canning takes credit for only 64-candle power for a consumption of 4 cubic feet in an incandescent gas-burner. Of course, the character of the burner and of the gas has to be taken into account; but 72 to 80 candles is not an uncommon result with a good burner, consuming 4 cubic feet of gas an hour. The cheapness of incandescent gas lighting leaves a large margin; but the cumulative effect of the difference pointed out is a valuable one. Like Mr. Canning, our admiration is great for the industry and the scientific skill that have been brought to bear upon the needs of the electrical industry. Like him, too, we are of opinion that the issue of the contest between the incandescent gas-lamp and the metallic filament lamps can well be left in the hands of the public.

Labour Congress—Old-Age Pensions.

The delegates of Trade Unionism have been in conference at Bath. There has been the usual outpouring of verbosity, and a repetition of all the old extravagances that have become indurated by time, but not accomplishments. Still Trade Unionism is cock-a-hoop. The present Government, have been kindly disposed, and have given to labour the Trades Disputes Act (which allows "peaceful" picketing, the true interpretation of which phrase has been given by Belfast), and the new Compensation Act. Much of what has been recently done in Parliament for labour is described by the President of the Congress (Mr. Gill, M.P.) as "con-"structive" legislation; but in regard to the larger portion of this particular legislation, we should prefer to replace the prefix "con" of the adjective by that of "de." However, the Trades Unionists cannot rest content for even a space; and, like the immortal Oliver, they want more. But, unlike Oliver, their wants are not limited by a basin of small capacity. As the leaders of Trade Unionism drift more and more to the broad stream of Socialism (some have already developed to Socialistic extremists), so their schemes become the more unpractical. Thus we have this annual conference of the delegates of Trades Unions made the debating-ground for all sorts of impossible projects, instead of for matters of real practical worth to the country's workers. These leaders and demagogues naturally become more hopeful of the realization of their dreams with their growth of power. Several members of Parliament, and many town and county councillors, are now of their own class and factions; and thoughts of swollen heads are uppermost as we read the reports of the pratings of the wealth of the political power of organized labour. We do not sneer at that power. Its greatness is beyond dispute; but we would that it were turned to really good purpose. Great, however, as the power admittedly is, it is insufficient to break down the social fabric, and give labour, by any short method or route, any substantial realization of the visions of those who lead. They assert an intention to have all they want; and even the House of Lords is not to be allowed to stand in their way. The House of Lords has given offence to the Socialists. The legislation to which that House has been a party in the interests of labour is, ungratefully, affirmed to have been due to fear rather than to any feeling of equity; but the rejection by the Lords of measures passed by the Commons is regarded as an unpardonable indignity on the "representatives" of the people. Therefore the delegates of associated labour are for the removal of the Lords.

The report to the Congress of the Parliamentary Committee contained a long list of wants, which the delegates are minded that labour shall get, whether the intelligent section of the workers of the country think well of them or not. There is the Miners' Eight-Hour Bill, which, if it becomes law, will permanently raise the price of fuel and other commodities to the workers of the country. That measure has to be passed, it seems, in the cause of the unemployed; and the employed, the steady, the thrifty are to be penalized in consequence. The same problem of unemployment is to be dealt with by a general legal restriction of the hours of labour—overtime is to be abolished wherever possible, and a universal eight-hour day applied. The President urged the abolition of overtime, as he is sensibly convinced that there is but little to be gained by kicking against growing application of machinery. Trade Unionists pay little attention to the fact that their excesses are largely responsible for the stimulation of the adoption of machinery in the industries. Mr. Gill is careful to ascribe the extension of mechanical operations to the necessity for economy and to the "inevitable." That is not the end of the causes producing certain effects; and, as we say, there is a further

and a powerful cause to be found nearer home. The Parliamentary Committee also placed the legal restriction of overtime in their recommended programme. But what must the President and the Parliamentary Committee think of the delegates who (agreeing with them in this matter) declined to pass a resolution pledging those present to do all in their power to discourage employment on Sundays? The sanctity of the Sabbath cannot by these Socialistic leaders and Trade Union roisterers occupy the same high-level ground upon which they place the sanctity of the interests of labour. If shortening the hours of work is to palliate unemployment, there should be completeness of action. Lessened hours, however, will not solve the problem of the unemployed. Nothing so simple will materially effect it. In no small degree, the solution of the problem is to be found among the unemployed themselves. Intellectual poverty and incompetence are largely the causes for unemployment in these times of brisk trade; and the adoption of the principles of Trade Unionism by so many men has fostered these deficiencies and produced degeneration. And there has been drummed into willing ears that the interests of labour demand that as little work as possible shall be done for a given rate of pay. Slackness of men, a mean grade of ability and of conscientiousness, and distrust, are the fruits; and these things can only be eradicated by those who have sown and nurtured them, and competent workmen be raised from the ranks of the unemployed, three parts of whom are at present unskilled, and only qualified for what can really be regarded as only shifting and temporary labour.

The question of old-age pensions is to be the chief plank in the platform of labour in the coming months; and pressure is to be brought upon the Government to deal with the matter next session. The anticipated surplus of the Chancellor of the Exchequer in the current financial year—which he has, before it is obtained, ear-marked to form a nucleus for old-age pensions—is not regarded as a sufficient guarantee for an early and adequate treatment of the subject. The Socialists desire that the subject shall forthwith be dealt with on a broad national basis. They want whatever scheme is materialized to be universal, non-contributory, and non-discriminative. The President and members of the congress put down the pension at not less than 5s. a week, and the age of sixty as that at which it could be demanded; and the Chancellor of the Exchequer is to be requested to make adequate provision in his next Budget for a commencement of pensions on these lines. The Prime Minister and the Chancellor of the Exchequer have both bound themselves to discountenance any scheme that is not universal, non-contributive, and non-discriminating; and, so far, they are in accord with the Socialists and Trade Unionists. In this, we are certain that both the Premier and Mr. Asquith are wrong. It would be grossly unjust for any nationally provided pension to be the right of the prodigal and the profligate. Therefore it is with some amount of favour that we look—writing subject to fuller consideration and discussion—upon the scheme suggested by Lord Avebury and others, as published in "The Times" last Tuesday. Into the details of the scheme we need not now enter; but it is founded on a contribution from friendly societies, other bodies, or individuals; and upon the fund so accumulated the Government it is proposed shall pay interest—the age of the beneficiaries being put at 65 years. The scheme is submitted as a reasonable, economical, and practical one; but we fear that the Government have committed themselves too far to entertain a project bearing any such characteristics. The scheme of Lord Avebury and his associates is based on the principle of the nation, through the Government, helping those who are willing to help themselves; and it provides the most effective test of whether or not a man desires a pension, in his willingness to pay something for it. The Trade Unionists call this trifling with the subject. The flaw we see in the scheme is the absence of provision for those who are in a position to prove that affliction or unpreventable penury are the obstacles, and not the want of willingness, to passing the test. Loth indeed should we be to see such men—the most deserving—barred from a pension in old age through uncontrollable circumstances. But no scheme will be free from blemish that does not compel the generality of workers to contribute something for what they are to receive, and certainly a pension that asks nothing of the beneficiaries will work irremediable harm upon thrift. This lesson is one that has been learnt in following up the successes of profit-sharing and co-partnership.

Effect of Low Prices at Sheffield.

The Chairman of the Sheffield United Gas Company (Mr. Wilson Mappin) was fully justified, at the half-yearly meeting of shareholders last Tuesday, in characterizing as "extremely satisfactory" the increase of 9·33 per cent. in the sale of gas in the six months ending the 30th of June, especially as it followed a rise to the extent of 7·21 per cent. in the corresponding period of last year. This growth in the Company's business affords striking evidence of the appreciation by the inhabitants of the district served by the Company of the efforts of the Directors to furnish them with a supply of gas at a figure which makes Sheffield conspicuous among the towns in which this business is in the hands of private companies. As the result of the liberal and progressive policy adopted by the Board, a gas consumer is now able to obtain for a penny a light of from 50 to 60 candles for 16 hours; and when this is compared with an ordinary electric lamp, which gives a light of only from 12 to 16 candles for four hours for a similar amount, the Chairman was quite safe in saying that gas has nothing to fear from the competition of electricity in the borough. There is just one element likely to disturb the happy condition of the gas consumer; that is the increasing price of coal. There is, however, a good balance—close upon £100,000—on which the Directors rely to enable them to maintain the present price for the next twelve months. As to what may be the ruling coal prices then, it would, of course, be folly to speculate. Mr. Mappin is of opinion, judging from past experience, that the existing "boom" will not last more than a year or two. Meanwhile, he is hopeful that the present condition of things will cause the public to reflect as to whether the Government are acting wisely in allowing such large quantities of all descriptions of coal to be exported free of duty, the re-imposition of which would, as he suggests, have provided the Chancellor of the Exchequer with the nucleus of a fund for old-age pensions. But Mr. Asquith expressed in the House of Commons, towards the close of the session, his determination not to re-impose a coal duty of 1s. per ton or any other amount; and his statement was received with cheers. Whether before the meeting of Parliament next year there will be such an expression of public opinion in this matter as to cause him to change his views, remains to be seen. Meanwhile, so far as Sheffield is concerned, there will be cheap gas available for all who require it for the production of light, heat, or power.

"Reserved for the Directors' Friends."

Limited in everything but its title and appetite for money is the Robertsbridge, Salehurst, and Hurst Green Water and Gas Company. We recognize in this concern one of a group of which investors are strongly advised to steer clear. A prospectus has been circulated announcing a fresh issue of 750 6 per cent. preference shares of £5 each in the Company and 200 ordinary shares of £5 each, unrestricted as to dividend. "Unrestricted as to dividend!" That is a new allurement; but we venture to say, with confidence, that there will be a large amount of restriction as to dividend from an undertaking with a large capital for the available business—merely supplying on sufferance in the rural districts of Robertsbridge, Salehurst, and Hurst Green. The prospectus is printed in red and black ink, and in large and small type. The shares are to be issued at par—"par" being printed in capital letters, for the purpose (we suppose) of preventing foolish investors making themselves more foolish by offering a premium. It is seen that the water is supplied in bulk by the Ticehurst and District Water and Gas Company (another member of the same family of virtuous ventures); and the "right"—who gave the "right"?—"to distribute such water and supply gas within a defined area is now vested in the Robertsbridge, &c., Company." The prospectus is full of cunning and non-committal statement—all designed to attract the unwary. Hearken to this: The Company "has a promising future, being situate in a part of Sussex where coal is *reported* to be found on Earl De la Warr's estate." Why "reported"? Has coal been found there, or has it not? The Directors of the Robertsbridge Water and Gas Company surely ought to know. Then, again, the water-rental book of the Company shows that "for the half year ending March 25 last, there was a 40 per cent. increase in water-rental and a 47 per cent. increase in new consumers." Why are the exact figures not given? Are their dimensions too poor to stand the light of publicity? There can be a 40 per cent. increase on a £5 note, and a 47 per

cent. increase on a number of consumers containing only double figures or even a single figure. Then, further, the Directors are "negotiating for the supply to several large residences in the district." But negotiation is not possession. So we go on with indefinite statement, till we come to the form of application, at the top of which we read the words printed in all the glory of red ink: "For allotment out of the shares reserved for the Directors and their friends." Now the particular copy of the prospectus before us was addressed to a lady, who, we believe it is right to say, disclaims all friendly connection with, or any desire for the friendship of, Dr. Allan Maclean, Alfred Schofield (a Director of the Water and Gas Debenture Trust), E. Eaton, C.E., "Consulting Gas and Water Engineer and Contractor, St. Leonards-on-Sea," and possibly of Cannon Street, E.C., or anyone else connected with the Company. The prospectus was accompanied by a letter printed in the style of type writing, and addressed to "Dear Madam." We protest strongly against the promoters of these concerns whose finances and prospects are not above suspicion, picking out lady gas and water shareholders on whom to practise their artifices, and also against the use of such decoying statements as: "Your application, if made on the enclosed form, will be entitled to *a small allotment* at par out of a few shares of this issue reserved for the Directors' friends." The Directors and John Harris, the Secretary, know full well that, within the terms of the issue, what applicants ask for they will receive; and their money will be handled with unfeigned pleasure.

Seventy Years' Progress at Sydney.

The proceedings at the annual meeting of the Australian Gaslight Company, which are reported in another part of the "JOURNAL," are of more than usual interest from the fact that the Chairman (Mr. G. J. Cohen) was able to give the shareholders some particulars, supplied to him by an eye-witness, of the improvements in the gas lighting of important public thoroughfares in London, Paris, and elsewhere, and thus to adduce evidence to colonials of the firm hold which this system of illumination still has on this side of the globe, notwithstanding the many attempts to displace it—or, as he put it, to "relegate it to the background." The example of London may well be held up to the municipal authorities of Sydney, if they contemplate, as it appears they do, lighting certain of the public parks. They will find high-pressure gas equal to all their requirements, and doubtless far less costly than electricity. But the feature of special interest in Mr. Cohen's address was his short sketch of the Company's progress in the seventy years of its existence. At first, the gas was supplied at a certain price per light; but when the supply by meter was introduced, the charge was 25s. per 1000 cubic feet, and the public lamps cost £10 per annum; whereas the figures are now 4s. and £4 respectively. The Company have upwards of 77,000 consumers, 2465 of whom came upon the books in the six months ending the 30th of June; and there are 25,000 houses fitted with prepayment meters. In proof of the appreciation by the inhabitants of Sydney of gas as a culinary agent, Mr. Cohen mentioned that the Company had sold 15,176 cooking-stoves, of which 564 had been placed in the preceding half year. Truly, the growth of the undertaking has been remarkable; and both shareholders and consumers have participated in its success.

Four Shillings a Day.

For some time past a motion has been standing in the name of a member of the Liverpool City Council, to the effect that a former resolution of the Council that able-bodied men employed by them should receive wages of not less than 4s. per day, should be altered by the omission of the words "able-bodied men," and the substitution of "men able to do a full day's work;" and at a meeting a few days ago it was discussed—and rejected. It was explained that the reason for the proposition was that, according to an official report issued a year ago, there were over 600 men employed by the Corporation at less than 4s. a day; and though it was admitted that these men were old, and could not do the arduous work they formerly did, the argument was put forward that "they did equally good work the whole day long, and by acting as they did the Committees were taking a mean advantage of men who had spent the best years of their life in the service of the Corporation." Apparently, this was regarded as sentiment by the majority of members; and some forcible reasons for the rejection of the motion were adduced. In the first place, it was urged that a corporation had a duty to employees which private persons had not; and the hope was expressed that the Corporation would, as far as possible, employ old men who would not be engaged by other people. This, surely, is a sufficiently generous view to take of a public authority's responsibility, without further saddling them with an obligation to pay "able-bodied" wages for such labour. In fact, as was pointed out in the debate, it is only reasonable to suppose that, had the resolution been passed, the effect would have been to make it impossible for the Corporation to take on elderly men, who would thus have been in a worse position than they now are, inasmuch as they would be exchanging a wage of less than 4s. a day for none at all. Further food for reflection on the part of those favouring a hard-and-fast "minimum wage" was provided by another member, who pointed out that, as the rigid regulation of wages progressed, the number of people who were not able to attain to it increased; and they were at the mercy of the sweaters. The only employment that was open to a man below full power, he added, was through the Corporation; and this was being closed more and more by the fixing of a rigid rate of wage. In other words, the question for such men seems to be whether half a loaf is not better than no bread. According to what transpired in the course of the debate, the men themselves have little hesitation as to what the answer should be.

The Question of Municipal Coal Supplies.

Equally—in fact, even more—unfortunate was another motion by the same member of the Liverpool City Council, that, in view of the large increase in the price of coal, it was desirable, both in the interests of the Corporation and of the general public, that steps should be taken towards breaking down the monopoly in the coal trade; and that the Town Clerk be instructed to take the necessary steps towards securing the co-operation of other municipalities in Lancashire, Cheshire, and Yorkshire with a view either to joint action in the purchase of coal mines or in pressing the Government in the direction of the nationalization of the coal mines. As only two voted in favour of the proposal, it may be assumed that (whatever the exigencies of the situation may force upon them in the future) the Corporation of Liverpool have no desire yet to carry their trading to the length indicated; while as to the alternative of pressing the Government to nationalize the mines, possibly the prevailing opinion was that the Government have already sufficient on their hands without the addition of such a scheme as this. The reason set forth for the motion was that the municipalities, as large consumers, were hard hit by the ring in the coal trade; and that it was time the Council, in co-operation with other authorities, should take some steps to break down the monopoly. On the other hand, it was argued that there could not be any monopoly in the coal trade when there were in Lancashire alone 115 collieries, in Yorkshire 172, and in Derbyshire 52; and that in Lancashire there could be no ring, because some of the largest colliery proprietors did not belong to the Association. This may be so; but, at any rate, there appears to be a good deal of unanimity in the manner in which prices are raised. As to price, it was stated that, during the past twenty-six years, there were only three occasions on which the Corporation could suggest that they had paid more than they ought to have done; and that if they had a colliery of their own, they would never be able to get slack so cheaply as they had been buying it. No doubt this is a pudding the proof of which would be in the eating; and this is a course which, as already mentioned, the Corporation are not inclined to adopt. To a final question put by one of the speakers no answer was vouchsafed—namely, what the Corporation would do with the coal that would be raised from the municipal colliery, seeing that they mainly used slack at the electricity works.

Manchester and District Junior Gas Association.—We learn from the Hon. Secretary of the Association (Mr. Alfred L. Holton) that the Council have felt the desirability of so altering the rules that the following points may be obtained: (*a*) Ample time for the new Council to prepare and publish a programme of the season's work; and (*b*) that only a portion of the Council should retire each year, in order that their work may have continuity. To secure these ends, the Council have prepared a set of revised rules, which will be submitted to the members at the annual general meeting to be held in Manchester on the 5th prox. Arrangements are being made for a joint meeting of the Junior Associations and a visit to the Manchester Gas Exhibition on the 2nd of November; and Dr. Harold G. Colman has promised to give a lecture on the 23rd.

THE NEW DEPARTMENT AT LEEDS UNIVERSITY

An Appeal from Sir George Livesey.

In the "Journal" for July 16, the prospectus of the new department of the Leeds University, which is to be specially devoted to the study of solid and gaseous fuel, was published; and in the same issue we were pleased to be in a position to write approvingly of the scheme, and to commend the work to the gas industry. There is a way by which the gas industry can show something more than an observer's interest in the new work; and it is on this subject that Sir George Livesey has, through us, addressed to the gas industry the following letter:—

Sir,—You have on several occasions mentioned approvingly the action of the Leeds University in establishing a "Professorship for Fuel, Solid and Gaseous"—thus extending to our industry the advantages they have conferred on other trades, such as dyeing, tanning, leather, &c.

Professor Smithells, F.R.S., Professor of Chemistry at the University, has put the matter before me; and I have led him to hope that the gas industry may provide the stipend of the professorship of fuel and gas, to which Professor W. A. Bone, F.R.S., has been appointed.

Discussing the matter with Mr. Corbet Woodall, we felt that the Gas Committee of the Leeds Corporation should head the list of subscriptions. The Corporation subscribe largely to the University; but this is to be a special subscription in addition. I wrote to the Chairman of the Gas Committee; and an annual contribution of £100 a year has been promised. The Gaslight and Coke Company and the South Metropolitan Gas Company follow with similar subscriptions; and I think I may promise £20 a year from the South Suburban Gas Company.

I thought of writing to certain gas companies; but, on coming to the point, I find myself in a difficulty. I never have made a personal appeal for money, and cannot begin now. I must, therefore, simply state the case through your columns, in the hope that the Gas Committees of the great Yorkshire towns will follow the example of Leeds, and that a number of Gas Companies will also help to raise the remaining £200 (or thereabouts) to make up an annual sum of £500 in subscriptions ranging, say, from £5 to £20 or £25. If a larger sum is offered than is necessary, the individual subscriptions shall be reduced proportionately to the business of the contributors.

I think the Institution of Gas Engineers might be asked to undertake the work of collecting the subscriptions in future if, as I hope, the gas industry responds to this appeal.

Sept. 7, 1907. George Livesey.

ANNUAL SUBSCRIPTIONS PROMISED.

Leeds Corporation Gas Committee	£100
Gaslight and Coke Company	100
South Metropolitan Gas Company	100
South Suburban Gas Company [expected]	20

EXHIBITIONS AD NAUSEAM.

A Proposed Gas Section at the Franco-British Exhibition.

The manufacturers of gas plant and appliances have shown a laudable willingness to co-operate in all work having for its object the welfare of the gas industry, in the fortunes—good or ill—of which they have part. For what they have of late years done, and are going to do immediately at Manchester, the gas-supply portion of the industry are deeply thankful; and we feel the gas-supply industry, as well as the gas plant and appliance manufacturers, will be with us in making at once a protest against any effort to encroach further upon the time, the good will, and the pockets of the latter.

There is to be at Shepherd's Bush next year what is to be known as the Franco-British Exhibition. With that exhibition, the name of Imre Karalfy is associated; and Imre Karalfy's name stands for spectacular effect and entertainment on the large scale. Primarily, the exhibition will be given up to amusement; but there are broad acres to be filled at Shepherd's Bush, and much money is required. It is therefore proposed that engineering should take a secondary place in the exhibition; and that the gas industry should supply a section. We have no quarrel with the promoters of the Franco-British Exhibition. We wish every success for the main part of their proposed show—the conception of which at the present time was clever; but we are not prepared to support in any way the second part of their venture. Sympathy has ever been evinced in these columns with industrial exhibitions, with entertainment in a secondary position; but we do decline—and it is hoped there will be general endorsement in the gas industry—to be parties to the industry occupying by representation the position of a sort of side-show in an exhibition which will be chiefly designed for the amusement of the public. Under such conditions, industry cannot harmonize with entertainment; and we feel sure that no possible good for the former can come out of the exhibition. With Earl's Court, Dublin, and the forthcoming Manchester Exhibition, we can for a period rest satisfied; and when another Gas Exhibition is required to publicly expose fresh achievements, the gas industry can, and will, afford to run it without the aid of outside promoters and public entertainers. The Society of British Gas Industries are co-operating with the Manchester District Institution of Gas Engineers in the promotion of the Manchester Exhibition; and in view of this we feel every confidence in saying that the Council will not lend their official countenance to the promotion of a Gas Section in the Franco-British Exhibition. The support or the abstention of the Society in the future will either make or mar an exhibition of the kind.

It is urged that if gas does not exhibit, the electrical industry will step in. And what if the electrical industry does—well, let it. There need not, however, be any fear on that score. The electrical industry is busy with an exhibition at Manchester next year; and there is no desire to have two on hand at one time. We are with the "Electrical Review" in this matter; and our contemporary is dead-against the electrical industry binding itself up in the Franco-British Exhibition. There is one suggestion we may make here: If the authorities want the exhibition lighted in an attractive and economical manner, we have no doubt that some of the lighting firms of the gas industry will be pleased to quote tempting prices for the service. Otherwise the gas plant and appliance manufacturers will not, we are certain, desire to be committed to Shepherd's Bush for several months during the summer of next year. The length of time, and the period of year, were the disadvantages in organizing the Gas Section of the Dublin Exhibition, which is an altogether different thing from that proposed by Imre Karalfy and his promoting friends, whose influence has secured the use of names (as patrons) of men standing in high esteem in the country. But this is a matter that has to be looked at from the commercial and industrial points of view, and not from those of the promoters.

LEGAL AND MORAL RIGHT OF GAS SUPPLY.

The ruptured relations of, and the contest that has arisen between, the Long Eaton and the Draycott Gas Companies (the subject of two brief references in the "Journal" last week) present a condition of affairs that we believe is without parallel in the history of modern gas supply. It is, as a rule, an excellent thing to suspend judgment until both sides to a cause are heard. But in this case we have before us the parliamentary history of the two Companies; and there is no difficulty in drawing from that history and the existing position of affairs a conclusion as to who are the transgressors.

The whole position is the result of neglect or indifference years ago in the case of the Long Eaton Gas Company, and of the stupid inconsistency of Parliament in granting in this instance dual powers for gas supply. The position is so peculiar that it is necessary to mention a few of the facts bearing upon the matter. The Long Eaton Gas Company were formed some 43 years ago; and in 1880, they obtained a Provisional Order, which defined an area of supply including, among other outlying areas, Draycott and Breaston. Seven years later, gas was required in Draycott. But the Long Eaton Gas Company took no steps to furnish it; and a local Company was formed. If it had not been for this enterprise, Draycott might have been left derelict to the present year, so far as gas supply is concerned. In 1888, the Draycott Company obtained an Act of Parliament, which gave them powers of supply in, among other places, Draycott and Breaston. This is the occasion when the Long Eaton Gas Company virtually, if not in express terms, surrendered their title to Draycott and Breaston by not appearing in opposition to the Draycott Bill. This is the first stage. The Long Eaton Gas Company did not attempt to supply Draycott and Breaston during the seven years following the granting of their Provisional Order; they did not resist the establishing of another Company there; nor did they appear in opposition to the granting of statutory powers to the Company. There was no objection; and silence gave consent. If the Long Eaton Company had been in occupation, Parliament would never have granted powers to the Draycott Company. The Company were, in fact, in possession of statutory powers for some years while the Long Eaton Company were still operating under a Provisional Order. It was in 1901 that the Long Eaton Company applied for an Act, in which they mapped out a district still embracing Draycott and Breaston, notwithstanding that their prior inertia had morally deprived them of all right to the district or to assail in any way those in possession. The Draycott Company petitioned against the Act; but the Court of Referees—with their traditional inconsistency—refused to grant them a *locus*; and thus it came about that over this one district two Companies are clothed with legal powers of supply.

Now the Long Eaton Gas Company—27 years after they first (by Provisional Order) obtained powers of supply, and 20 years after the establishment of the Draycott Company, and 19 years after the latter started to work under an Act of Parliament—have run their mains into the Draycott Company's district, and are competing with them. They do so in a manner which is

diametrically opposed to custom and parliamentary practice in the matter of differential prices as between the primary distriet and the outlying areas. The Draycott Company have served their area well in regard to price. With discount, the ordinary consumers in Long Eaton have been paying 2s. 8½d. per 1000 eubic feet; the Draycott Company have gradually reduced their ordinary price until it has got down to 2s. 6d. Now the Long Eaton Company have run their mains 2 miles into the Draycott Company's area, and are offering to supply at 2s., and to give other advantages to those who will patronize them, and so have forced the Draycott Company, who have carried out their powers faithfully, to level-down their already low terms. But in Long Eaton, the price remains for ordinary consumers at 3s., less 10 per cent. discount. That is an inversion of parliamentary practice, which allows a price to be charged in outer districts higher than that obtaining in the main part of the supply area; and it is opposed to the modern eondition that rebates from the ordinary price are to be uniform under similar circumstances of use. We feel sure that Parliament, if the matter could be submitted to them, would discountenance what the Long Eaton Company, as a statutory concern, are now doing. The Long Eaton consumers will not long approve these tactics, which give to new and outlying customers gas at a cheaper rate than to the home consumers. If the Long Eaton Company can afford to supply, along two miles length of main in the Draycott Company's district, gas at 2s. per 1000 cubic feet, then they can better afford to supply nearer their works at a lower price than 2s. Cut-throat competition of this kind never did, in the end, work any good to the gas consumers nor to the gas vendors.

What is the object of the Long Eaton Company in taking this action? If it is only an old-age repentance, then honour ought to have stayed action. Perhaps, however, the Company now covet the Draycott Company's area, and are attempting to depreciate their property, or to starve or crush them out. But the Company in long-standing possession are the stronger, and (shall we call them?) the freebooters are the weaker; and their weakness is shown by the length of time that has elapsed before entering the district, and the big sop they have to offer in the shape of (looking at the ordinary charge for gas in Long Eaton) an uncommercial price to draw custom from the Draycott Gas Company. However, whatever the purpose of the Long Eaton Company, whatever the upshot of their action, sympathy will be on the side of the Draycott Company, who have both legal and moral right on their side, while the Long Eaton Company have only legal right, which we make bold to say they would not have maintained if the matter had been submitted to the decision of a Select Committee in 1901. There is a legal maxim "*Æquitas sequitur legem.*" This is decidedly a case in which equity should prevail, and set right what (unless fresh light can be shed upon the matter other than that which we have gained by looking into the history of the present position) we can only regard as an injustice, the like of which has had no previous existence in the gas industry.

OBITUARY.

The death occurred on the 31st ult., as the result of an attack of pleurisy and congestion of the lungs, of Mr. W. P. Hotchkin, who for 23 years held the position of Manager of the Coggeshall Gas Company. He leaves a widow, two sons, and three daughters.

The death took place last Thursday, at Gawber, near Barnsley, of Mr. Joseph Taylor, who was three times Mayor of Pontefraet, of which town he was a native. Much of his time was devoted to the affairs of the Pontefract Gas Company, in connection with which he occupied the position of Chairman, until the undertaking was acquired by the Corporation this year. For six years he represented Pontefract on the County Council; and he was placed on the Commission of the Peace in 1883.

The current number of "Le Gaz" records the death, on the 3rd ult., of M. Charles Mariez, the Engineer of the Nancy Gas-Works. It will probably be remembered that the annual meeting of the Société Technique du Gaz en France was held at Nancy last June; and in connection with the report of the proceedings which appeared in the "Journal," a sketch was given of the development and progress of the gas-works. M. Mariez was born in 1843, and left the École Centrale in 1868 with the diploma of Engineer of Arts and Manufactures. His first engagement was with the Compagnie des Chemins de Fer des Charantes; but in July, 1879, he was entrusted by M. Ellissen with the management of the gas-works of the Continental Gas Company at Evreux. When the Company beeame co-proprietors of the Naney works, which had been established by the Constantin family, he was associated with the management in October, 1883; and sueh was the confidenee placed in him that he was allowed to have the entire eontrol. On the death of M. Jules Constantin in 1889, the Nancy Gas Company appointed M. Mariez their Manager; and under him the coneern made rapid progress. He earried out a number of extensions, and introduced plant of the most approved kind, as shown by the accounts whieh have appeared in our pages. It was acknowledged, on the oecasion of the visit of the French Soeiety in June, that everything upon the works bore witness to the able control of the Manager; and his death will, we are sure, be mueh regretted, as well by the Company he served as by his professional eolleagues, whose sympathies will be extended to the family in the great bereavement they have sustained.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 719.)

The general condition of affairs on the Stock Exchange last week presented no very stable characteristic, but rather a variety of fitful movements. At the same time, the volume of business was so extremely limited that these movements were not sharply perceptible. The sluggish tide alternated up and down, and never for long at a time—perhaps going one way in the morning, and the other way in the afternoon. It was a short week, too (the Exchange being closed on Saturday), and that helped to tame things down. The opening on Monday looked fair, and there was some buying of good investment stocks. But Consols were not among them, and closed ⅛ lower. Railways also were not good; the advance in the price of coal being suggested as a bad point. Tuesday was a very slack day; but the tone on the whole was tolerably cheerful, though the gilt-edged division did not share in it. Wednesday afforded promise of greater briskness. It soon, however, subsided; and by the end of the day any little advance was mostly lost. Things were perhaps quieter than ever on Thursday, and sheer inanition produced a degree of dulness. Friday was a change for the better—some little buying in choice lines having a beneficial effect. Consols recovered ⅛. In the Money Market, there was an abundant supply, and terms for short loans eased away materially. Discount rates took a harder turn at first, in view of gold being secured for abroad; but later on an easier condition ensued. Business in the Gas Market was quite on a holiday scale, and there was hardly any alteration in quotations. But the tone was quite firm; and the two or three variations marked were all in the upward direction. In Gaslight and Coke issues, the ordinary was lightly dealt in at close figures, which did not range outside the limits of 93½-94. The secured issues had their full share of business. The maximum changed hands at from 86 to 87¼, the preference at from 104½ to 105¼ (a rise of 1), and the debenture at 81½. South Metropolitan was moderately active, and advauced half-a-point; transactions ranging from 119 to 120½. The debenture was done at 81½ and 82½. In Commercials, the 4 per cent. was marked at 102, and the 3½ per cent. at 101 (after a small parcel had been done free at 99). The debenture marked 81 free and 82. Hardly anything was transacted in the Suburban and Provincial group. Tottenham "B" changed hands at 101½, and West Ham at 103¼. The Continental Companies were very inactive. Three or four deals in Imperial were done at from 174½ to 175½; and one in European fully-paid at 22¾. Among the undertakings of the remoter world, Bombay was marked at 6⅝ and 6½, ditto part-paid at $4\frac{13}{16}$, Buenos Ayres at 11⅛, Melbourne 5 per cent. at 101⅜, Primitiva at $6\frac{15}{16}$, ditto preference at 5, ditto debenture at 94½ and 94¼, and River Plate at 13⅜.

ELECTRIC LIGHTING MEMORANDA.

Increase of Electrical Accidents—Fatalities at Low Pressure—A Scientific View of the Physiological Influence of Electrical Currents—Home Office Regulations—New Lamp Developments.

Much matter of importance has of late occupied attention in the "Memoranda;" and consequently notice of the electrical section of the recently issued annual report of Mr. G. S. Ram, Inspector of Factories, has had to be withheld until uow. It is regrettable to find that the electrical accidents reported as having occurred in engineering works, &c., show a considerable increase over those of the previous year; the number having risen from 122 to 199, or over 60 per cent., including eight fatalities against four in the preceding year. To the expansion of the industry, the increase is partly due; but at the same time those engaged in the electrical industry cannot be acquitted of all blame for not taking greater precautionary measures. Rules and regulations are made for wiring and fitting up; but who enforces them? Mr. Ram would not have so much room for criticism if electricians would be less academical, and somewhat more praetical. We are not exceeding the limits of fair criticism in saying this when we find Mr. Ram remarking: "The increase is scarcely to be wondered at in view of the fact that the necessity of proper precautions being taken is often not realized by the occupier, who aceepts the lowest tender for his installation without being aware that the price is low beeause the apparatus is inferior, and often without the elementary safeguards." Also, later on, the Inspeetor condemns the dangerous character of some of the arrangements —"death traps" is an expression used in one part of the report—at electricity generating stations. How is it possible to reprimand the eonsumer when sueh faults are found in the electrician's own particular domains?

Regarding the protcetion afforded the uninformed user of electricity, it is seen that, of the total number of aecidents already quoted, "faulty apparatus," other than switches, was responsible for no less than 37 non-fatal aceidents and two fatal. The somewhat more numerous accidents under this heading oecurred, with one or two exceptions, in connection with the use of portable appliances—generally lamps. The injuries were most severe burns to the hand due to short-circuits occurring in the plug or the lamp fitting, or in the flexible wires where they enter the plug or lamp fitting. The severity of many of the burns is undoubtedly

due to the circuits being too heavily fused; thus allowing very heavy currents to flow under short-current conditions. Wherever portable appliances are used in places where the persons handling them are not insulated from earth, special precautions, Mr. Ram urges, should be taken, as there is always a possibility, or even a probability, that there will be a leakage in the portable appliauce. As is evident by two fatalities quoted by Mr. Ram, the person holding the lamp or other appliance may be unable to drop it, and a fatal shock is the result even where low pressures are used. The common pressures nowadays are 200 to 230 volts; and it was at these respective voltages that the fatalities occurred to which Mr. Ram refers. In a later portion of the report, it is found that all fatal accidents recorded as having taken place on factory premises were due to shock from alteruating current, at various pressures down to 200 volts; no less than four occurring at this pressure. It is customary when fatalities happen at such low pressures for people to say that the victims must have had weak hearts. But Mr. Ram asserts that this view is seldom confirmed; the post-mortem examination often proving the contrary. The danger with low pressures depends upon the path of the current through the body and the kind of contact. People who are responsible for electrical installations do not sufficiently realize the hidden dangers of low-pressure currents; and hence the weak-heart theory is trotted out at every inquest. The danger should not be minimized by trying to shift its effects on to another cause; better will it be to utilize the known danger to bring about a greater perfection in iustallation fittings and appliances, care in workmauship, and a better recognition that electrical fittings will not last for ever. As the "Electrician" puts it, "faults are liable to occur in due time in all apparatus through wear and tear." An instance of this was afforded by an inquest held at Newcastle the other day. The subject was John Allan, who lost his life through electric shock. The deceased man was proceeding to attend to an electric pump at a colliery at Ashington, when he found a cable hangiug from the roof. On lifting it, he immediately fell. The cable had a few days before been examined by "the eye;" but subsequent to the accident, a more thorough inspection was instituted, when it was discovered that the insulation was damaged. The Electrical Engineer considered that this could only have occurred by reason of electric current leaking from one coil of the three-coil cable employed. The outside covering of the cable was found to be burnt for about 1½ inches.

While on this subject of accidents, it may be noticed that Herr Hermann Zipp, lecturer at the Municipal Polytechnic at Cötheu, has been considering the danger to human life introduced by accidental contact with an electrical current; and he comes to the conclusion that the extent of the injury is not entirely due, as is generally imagined to be the case by non-technical people, to the voltage of the current, but partly or mainly depends on the quantity of electricity which is caused to flow through the human body, and upon parts of the system which it penetrates. Experiments that have been carried out on the physiological influence of electrical currents show that part of their effect is due to their electro-chemical action upon the liquids of the body, and part to the injury done to the most important organs by contact with the current of electricity. Herr Zipp enjoins special care in using portable electrical apparatus such as hand-lamps and motors when the atmosphere is damp.

Within a few weeks after the issue of Mr. Ram's report, there comes to hand the draft of the regulations proposed to be made by the Home Secretary for the use of electricity in factories and workshops. To publish the regulations and the accompanying matter would occupy some columns of our space; and so we will content ourselves with reference to a few general matters in the preamble to the regulations. The draft applies to all premises under the Factory Act, and to all pressures above 130 volts continuous and 65 volts alternating. In adopting these limitations on the basis of pressure, the Secretary of State, while realizing that there may be danger at still lower pressures, has been guided by the fact that the serious accidents from shock which have come to his notice have been at pressures exceeding those named. Special consideration has been given to the conditions under which preventable accidents have arisen. The Secretary of State regrets to learn that, while in many electrical installations the utmost care has been taken to prevent unnecessary danger, there are striking exceptions to this rule, even in work recently carried out. It appears to be often thought that, where the supply of electrical energy is at low pressure, there is no danger of shock, or rather there is no danger to life from a shock at such pressure. It has, however, been abundantly proved (by Mr. Ram's reports for example) that this is not the case. Fatal cases of shock at low pressures are by no means of rare occurrence. Accidents from shock may occur by a person making contact simultaneously with two live conductors at different pressures, but more usually by merely touching one conductor while being in contact with the ground. Mere momentary contact with a conductor at low pressure, even when standing on damp ground, may not produce a serious shock. But a person who happens to grasp the conductor may be quite unable to release his hold; and the shock is prolonged until assistance comes. In such circumstances, it may take only a few seconds for the shock to prove fatal. The dividing-line between the conditions which will render the shock merely trifling and those which will render it fatal, is so narrow that it becomes necessary to provide, so far as is practicable, that no shock shall be received at all. However, with all this attention to the precautions necessary in installing electricity, and with the lengthening record of accidents happening under varied and new conditions, the harmlessness of electricity continues to be proclaimed.

It was in accordance with the fitness of things that the developments in electric incandescent lamps should have been brought before the meeting of the British Association at Leicester. The task was undertaken by Mr. Leon Gaster, whose name is continually coming forward in connection with matters affecting illumination—especially electrical. One feature of the paper is that Mr. Gaster does not take an inflated view of the prospects of the new metallic filament lamps, but as becomes an electrician he treats them in a hopeful spirit. He points to the fact that no great further improvement has been effected in the efficiency of the Nernst lamp, and mentions that Welsbach's "Osmium" lamp, owing to the expensive nature of the metal used, and to the difficulty of manufacture, is likely to be restricted to low voltages. The "Tantalum" lamp is the only metal filament lamp which has proved commercially successful; but it is only made for voltages up to 125. Mr. Gaster speaks with more confidence of the tungsten (wolfram) lamp; but he puts his finger on a weakness of the "Osram" lamps (also for low voltages) when he says that they have to be used with the filament in the vertical plane. This led him to describe an improvement (about which we have doubts as to its permanency) in connection with the zircon-wolfram lamps, whereby they have been rendered fit for use iu any position. The filaments are mounted on spring hooks made from tungstenized carbons. The hooks have the effect of maintaining the filament rigid and in shape while in service, and of preventing the loops from touching, also of allowing a greater number of filaments in a bulb, and consequently of reducing their length as well as that of the lamp. Mr. Gaster gives his authority for stating that the elasticity of the spring hooks has "reduced" the breakage of filaments, both in transit and in service. The latest type of 110-volt lamp is made to contain only four filaments, measuring 0·025 mm. in diameter, giving 24 Hefner units, or for 220 volts 48 Hefner units, necessitating the use of eight filaments. The helion lamp is one about which the author speaks a little more definitely.

This particular creation looks like an ordinary carbon incandescent lamp, and with the same sized bulb. But, unlike the carbon filament, it only consumes 35 watts, and returns something like 30-candle power. In the manufacture of the filameut, silicon is reduced from the gaseous form in combination with carbonaceous gases on the surface of a high-resistance carbon core. A useful life of between 600 and 1000 hours is claimed; but a proper series of life-tests has not been made, as there seems to be a difficulty in keeping the joints between the filament and the leading-in wires in good condition. If there is not one defect in these new lamps, there seems bound to be another. Like other lamps of the new type, great care has to be taken in the selection of the carbon core and in manufacture; otherwise the results are considerably affected. The filament, however, is very pliable; and Mr. Gaster asserts that "there will be no difficulty (if the present defects, which are chiefly of a mechanical character, are overcome) in making lamps of low and high voltages, and of reasonable candle power." The great poiut about Mr. Gaster's paper is that the manufacturers of the metallic filament lamps are working their way up to the higher voltages; but there are many "ifs" about the later lamps, much that is merely tentative, and commercial certainty is not within grasp. It is understood that it is not the intention of most of the manufacturers to sell for the present other lamps than those of "high" illuminating power (above 30 candles), and for voltages varying between 100 and 130. So the position has not really changed; and many are still searching for an answer to the question as to how the new lamps are going to benefit, in a tangible way, the British electricity industry.

Artesian Wells in Australia.—According to an article in "Engineering," the first actual discovery of artesian water in New South Wales dates from 1879, when a supply was obtained on a pastoral holding between Bourke and Wilcannia, at a depth of about 140 feet—the water rising in the pipes to a height of 26 feet above the surface of the ground. The success of artesian boring was, however, first demonstrated on an extensive scale at Kerribee station, where a bore was sunk to a depth of 1073 feet, which yielded 350,000 gallons per day. The first Government bore was sunk in 1884 at Goonery, on the Bourke-Wanaaring road to a depth of 89 feet, with a resulting flow of 24,000 gallons per day. The two bores previously mentioned were made by private individuals. Since 1884 the manifest advantages of the artesian wells have been so evident that, in spite of the great difficulties of transport and the cost of boring in the earlier stages, as many as 412 bores have been sunk in this State, 54 of which are sub-artesian, and require mechanical means for raising the water to the surface. The failures among these bores have been about 10 per cent.; there having been 41 failures out of the 412 bores. Among the failures, however, are included test-bores, and bores put down against expert advice. In the matter of enterprise in this direction, when compared with the neighbouring State of Queensland, New South Wales shows a good record; for out of the 412 bores put down, 130 of them have been sunk by the Government against (approximately) 120 in a total of 1132 in the State of Queensland.

THE ILLUMINATING POWER, IN ORDINARY AND INCANDESCENT BURNERS, OF COAL GAS, WATER GAS, AND MIXTURES OF THE TWO GASES.

By M. Emile Sainte-Claire Deville.

[Abridged Translation, with Comments, by W. J. Atkinson Butterfield, M.A., F.I.C., of a Communication presented to the Meeting of the International Photometric Committee in Zurich, July 18 to 20.—Continued from p. 626.]

Water-Gas Tests.—Work on lines indicated in the preceding paragraphs was carried out on coal gas only in 1901 and reported in the author's communication in 1903.* It was extended to water gas and mixtures of water gas with various proportions of coal gas in 1904. But the procedure was altered slightly. In 1901, a Foucault photometer with two bars and an electric glow lamp as a secondary standard were used; but by 1904 the laboratory had been entirely remodelled. A Welsbach burner No. 2, with governor, was adopted as the secondary standard; and the photometer was a single bar, 5 metres (=16·4 feet) in length. A Simmance and Abady pattern photometer was used on this bar for comparing the secondary standard with the Carcel lamp; and a simple reflecting photometer formed by the edge of a meerschaum prism was used for comparing the burner under examiuation with the secondary staudard. This proved quite satisfactory. The general arrangement is shown in fig. 3. In this plan, A represeuts the auxiliary

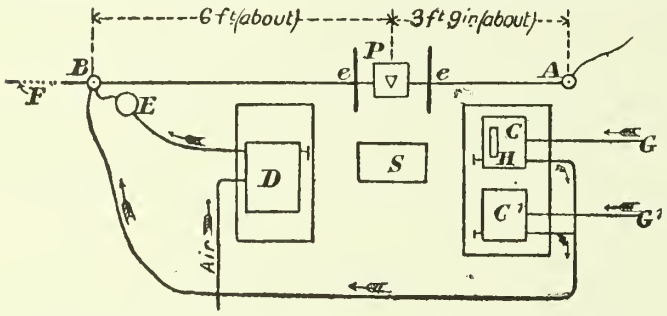


Fig. 3.

standard set up at the zero of the photometrical scale. This standard was a governed No. 2 Welsbach burner, consuming the ordinary gas as supplied to Paris. B is the test burner, with artificial supply of air, movable on the bar. A F is the photometric bench, which extends beyond F to a total length of 5 metres (=16·4 feet), and is furnished with a scale. P is the meerschaum prism photometer, which travels on the bar. A Simmance and Abady photometer can be placed on the same carrier. Two black screens, *e e*, travel with the photomctric prism, haviug openings in the line of the photometer. The observer sits at S. H is a seconds clock; G is the supply-pipe; and C is the meter for gas No. 1, and G¹ and C¹ the pipe and meter for gas No. 2. D is the air-meter, and E a desiccating tower through which the air is passed. The "Bébé" type of mantle was employed in 1904, instead of the "No. 1" mantle used in 1901, and was of better quality intrinsically.

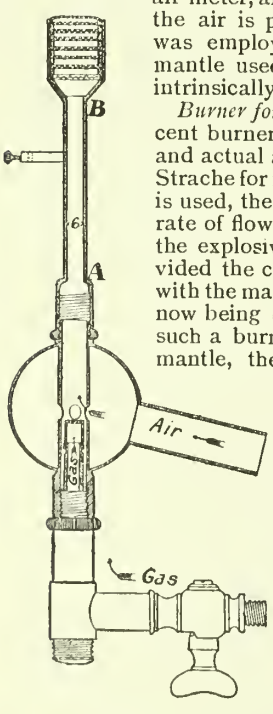


Fig. 4.
Burner for No. 1 Mantle (about one-third natural size).

Burner for all Kinds of Gas.—Ordinary incandescent burners are inapplicable with neat water gas, and actual argand burners have been used by Dr. Strache for it. But if a burner with artificial air-feed is used, the mixture of air and gas may be given a rate of flow in excess of the rate of propagation of the explosive wave in the opposite direction, provided the consumption is as high as is consistent with the maximum duty, which is the only condition now being dealt with. The author has produced such a burner in two sizes—one for the "Bébé" mantle, the other for the No. 1 mantle. The one for the "Bébé" mantle answered best; and it was also convenient to use this mantle because its lower consumptiou admitted of a greater number of tests being made from the gas contained in a small holder. The larger burner was liable to light-back occasionally, and required a little modification to overcome this defect. Fig. 4 shows the burner, which differs from that used with the "Bébé" mantle only iu respect of size. The essential dimcnsion, however, is the internal diameter of the tube A B; and this is 6mm. (about ¼ inch) in both burners. The head of the burner contains rings of metallic gauze, surmounted by a perforated top.

Variations in the Duty afforded by Neat Water Gas according to Proportion of Air.—Before passing on to the specific duty of particular gases, it may be best to show that the proportion of air plays the same part with water gas as with coal gas. Using a "Bébé" mantle, Brand "A," No. 4, with water gas of good quality having a calorific power of 2699 calories per cubic metre (303¼ B.Th.U. per cubic foot), and requiring 2·31 times its volume of air for complete combustion, the results shown in the following table were obtaiued in December, 1904. (The corresponding figures for coal gas were given iu Table III., on p. 625.)

Consumption of Gas. Cubic Feet per Hour.	Volumes of Air per Volume of Gas.	Illuminating Duty.	
		Candles per Cubic Foot.	B.Th.U. per Candle.
10·66	1·80 (*a*)	14·33	19·2
,,	2·06 (*b*)	16·40	16·8
,,	2·23 (*c*)	14·74	18·7
13·35	1·79 (*a*)	14·26	19·3
,,	2·03 (*b*)	16·67	16·5
,,	2·24 (*c*)	14·56	18·9
15·54	1·76 (*a*)	13·30	20·7
,,	2·03 (*b*)	17·33	15·9
,,	2·29 (*c*)	14·03	19·7

(*a*) Inadequate air supply; (*b*) correct do.; (*c*) excessive do.

The foregoing testings were all made under the conditions of absolute maximum duty corresponding with the horizontal portions of the curves in figs. 1 and 2 (p. 626). They show that the proportion of air which affords the specific illuminating duty of the water gas is 2·04 volumes to 1 volume of gas.

Procedure Adopted for a Series of Testings.—The specific illuminating duty was determined for several gases one after the other under identical conditions in this manner: Meter C supplies No. 1 gas, which is coal gas; and Meter C¹ supplies No. 2 gas, which is neat water gas. The secondary standard was always assumed, for the sake of simplicity in the calculations, to have a value of 6 carcels (= 58·8 candles), though in reality comparisons showed that its mean value was about 6·3 carcels (= 61¾ candles). The absolute value is not of much moment for the present purpose. The Welsbach light that was used as a secondary standard remained quite constant in intensity throughout the short time required for a complete series of testings; and that is the essential point. The distance of the standard burner on the photometer-bar is fixed beforehand, so that for an absolute intensity of from 15 to 18 carcels the prism or photometer proper is immediately in front of the observer's chair, which is placed so that he can readily control the taps of the three meters. The gases are burnt for some time through flat-flame burners, in order to clear the meters; and the standard is lighted at least half-an-hour beforehand. After these preliminaries, the specific duty of the coal gas (No. 1) is determined by turning on the gas to the burner, then the tap on the air-meter, and lighting.

On adjusting the taps systematically, it is found in practice that in about one minute the iutensity can be made such that the two faces of the prism are equally illuminated when its carrier is shifted only a little (that is to say, the intensity of the light is between 15 and 18 carcels, or, say, 150 and 180 candles), while the air supply is such that it cannot be appreciably altered either way without lowering the intensity of the light. Then by an observation occupying three minutes, all the necessary data for calculating the specific duty are obtained. Then, by gradually turning off gas No. 1, and at the same time turuing on gas No. 2, water gas is substituted for the coal gas without putting out the burner. The regulation of the gas and air supplies is carried out as before; and the three-minutes observation is then made. Afterwards testings are carried out with mixtures of coal gas and water gas in proportions as indicated by readings of the two meters; aud the changes from coal gas to water gas and to various mixtures of the two may then be rung as often as desired, until the observer's eyes become fatigued, or the air-holder is emptied.

In the laboratory, analyses of the two gases and determinations of the calorific power and specific gravity of the supply are carried out while the photometric observations are in progress. The theoretical temperature of the flame is calculated from the analysis by Le Chatelier's method, as well as the proportion of air requisite for complete combustion. If these determinations are made on the two neat gases, the corresponding figures for the various mixtures of the two are readily calculated from the proportions. The results of a series of observations are then tabulated in the order of descending flame temperature and ascending calorific power—that is to say, commencing with water gas and proceeding through mixtures gradually increasing in their content of coal gas to coal gas itself. The results of five such series of observations, with coal gas and water gas of varying qualities, are presented by the author in detail in lengthy tabular statements. [A summary of these will be given next week.—Ed. J.G.L.].

* See "Journal," Vol. LXXXIII., pp. 499, 567, 617.

TRADES UNION CONGRESS.

Points from the Bath Gathering.

It is the general custom for the annual Trades Union Congress to receive a certain amount of preliminary advertisement; but this year perhaps the notice given to the approach of the event by the general Press was rather more extensive than usual, owing to the fact that there had been a "split." In 1905, the Amalgamated Society of Engineers and the Durham Miners' Union, after some years' absence, decided to again take part in the proceedings of the congress; but on the present occasion the former body once more expressed their inability to join in the gathering. However, in spite of this very unkind action, the usual speeches were made, and the customary resolutions were passed, at the fortieth annual congress, which was held last week at Bath. In fact, it is reported that, in spite of the severance of the Society of Engineers with its 100,000 members, the number of Trade Unionists represented was a record. There were 521 delegates, which was an increase of 30 on last year; while the Trade Unionists represented numbered 1,693,000, as compared with 1,550,000. At first sight, one might wonder whether this increase was solely due to the fact that on this occasion the congress possessed a new feature, in the shape of the inclusion of the representatives of the various organizations connected with the theatrical profession. On going more closely into the matter, however, one learns that there has been a general advance in membership of the various Unions; the most striking increases being 30,000 miners and 12,000 railway servants. Those who have, even casually, followed recent proceedings in the colliery districts, and have noted the determined efforts of the Miners' Federations to force all non-Unionists into their ranks, will hardly be surprised at the addition to the number of Unionists that has taken place there; while the greater popularity of Unionism among railway servants is, of course, explained by the agitation for better terms of employment which certain leaders have been engaged in on behalf of the men.

At the close of their report on the work of the past year, the Parliamentary Committee naturally had something to say on what has been achieved in respect of the Trade Disputes Act and the Workmen's Compensation Act. But these gains sink almost into insignificance when placed beside the formidable list of social and industrial reforms that the members are now urged by the Committee to "take up," with determination and energy, both inside and outside Parliament. These are as follows: A miners' legal eight-hour day, and a reduction of hours in all trades; old-age pensions; the unemployed question; compulsory State insurance; land nationalization; the amendment of the Poor Laws; and the legal restriction of systematic overtime. The position of greatest urgency is given to old-age pensions, with regard to which the Committee appeal for a vigorous campaign to be held throughout the country during the coming autumn. "Some may say," continues the report, "that the condition of the working classes has improved greatly; but no man will say, who knows anything of the facts, that the state of the people as a whole has advanced in proportion to the increase in the national wealth. Though much has been done, there is still more to do; and in this direction a noble opportunity is put before the Trade Unionists of this country." The welcoming of the congress to Bath by the Mayor (Mr. S. W. Bush), the election of scrutineers, &c., comprised the business of the first day.

The proceedings on Tuesday opened with the address of the President (Mr. A. H. Gill, M.P.), who, with reference to future policy, differed a little from the Parliamentary Committee, inasmuch as he assigned the foremost place to the Miners' Eight-Hour Bill. In considering the question of unemployment, some effort was made to arrive at the causes of the want of work, which Mr. Gill admits is not peculiar to this country. The first enumerated are the extension of machinery, and greater pressure being put upon workmen to get out more work. The result of this pressure, it is claimed, has been that the productive capacity in the various departments has increased by fully 25 per cent. with the same number of workmen in the same time; while the increased demand for commodities has not kept pace with the extra productivity of machinery. Overtime is still put down as another fruitful cause of want of employment. Turning to a solution of the problem, Mr. Gill admits the impossibility of fighting against machinery; and the congress, it is to be hoped, made careful mental note of his candidly expressed opinion that they "can no more keep back the spread of machinery than Mother Partington could keep back the tide with her broom." The course he suggests as a remedy is the concentration of energies towards securing the best possible wages for working the machines; the abolition of overtime wherever possible; in cases of depression, the reduction of the hours of all, rather than the discharge of some men and the retention on full time of others; in trades where depression was most severe, a permanent reduction of hours. As to old-age pensions, the only scheme that will really be satisfactory from the President's point of view will be one that is universal, non-contributory, and non-discriminatory, and that provides not less than 5s. per week at the age of sixty. The question of where the money is to come from—an important one, when the expenditure involved must, on the most favourable of computations, amount to many million pounds yearly—was not a matter with which the President felt called upon to greatly trouble himself. To find the sum necessary is, he said, the duty of the Chancellor of the Exchequer. A suggestion was, however, modestly put forward by Mr. Gill to the effect that if the Minister in question "will turn his attention to the unearned increment which has accrued to landlords from the land, the mining royalties which in other countries go to the State, but which are here appropriated by the landowner, and the large fortunes which are left, and which have been made by the industry of the workers, he will find sources which can be legitimately tapped."

The address having been thus satisfactorily disposed of, the congress settled down to the consideration of the Parliamentary Committee's report; and, as usual, a lengthy discussion ensued. On the question of unemployment, one speaker asked whether the Committee did not think it necessary to draw the attention of the Government to the large number of skilled and unskilled workmen who were being thrown on the unemployed market through the operation of the insurance companies in regard to the Compensation Act. It was, he said, their experience that some of the best men were being thrown out of work because of a few grey hairs or some slight infirmity. In this matter, the Right Hon. John Burns came in for some rather strong criticism from his one-time friends and allies; one delegate going so far as to say that it was the whole intention of the Liberal Government and of Mr. Burns that the Unemployed Act of 1905 should be a failure.

Wednesday was devoted to resolutions; and the first, which was carried unanimously, was ordered to be cabled to Antwerp—to which port it had special reference. One member suggested that, in addition to the moral support (which it is doubtless imagined will be thereby afforded), the congress should dispatch material help to the strikers, in the shape of £500. But this proposal the President declined to accept. The resolution was as follows: "This congress expresses its severest censure upon those Britishers who have thought proper to engage themselves to cosmopolitan syndicates to interfere in foreign labour disputes, believing that such action is purposely adopted by unscrupulous capitalist combinations to generate and foster bad feeling between the workers of different countries, and to counteract the universal tendency of the workers of the world towards comradeship and mutual helpfulness in all matters affecting their international welfare. Further, this congress suggests that the British Government should seek powers from Parliament to apply the principles of the Foreign Enlistment Act to such as organize these blackleg expeditions to other States, and so prevent the possibility of foreign complications arising from such dangerous conspiracies." The House of Lords came in for quite a flattering share of attention; and ultimately it was unanimously agreed to strongly urge upon the Government to take such steps as will secure the abolition of "that privileged assembly," and to protest emphatically against the creation of any further new peerages. Among other matters, it was decided to have a special conference of Trade Unions to discuss the by no means new question of establishing a daily Labour paper. A resolution in favour of the abolition of all overtime was also passed.

The remainder of the week was taken up with the consideration of other matters of character varied enough to please everybody. As the result of an accusation of "sweating" brought against the Salvation Army by the Amalgamated Society of Carpenters and Joiners, the Parliamentary Committee were instructed to open up negotiations with the Army so that an inquiry may be made. Compulsory arbitration in trade disputes was again suggested, in place of that disastrous weapon "the strike." But it met with nothing like general favour; and the idea was rejected after Mr. W. Thorne, M.P., had urged that in practice it was impossible to enforce compulsory arbitration, because while the workers would have to accept an adverse decision, the employers could not in a like case be compelled to keep their factories open. Later on, the Government were unanimously urged to at once embark upon works of public utility, with the object of absorbing the present unemployed labour, and of "laying the foundation for a permanent re-organization of industry upon a co-operative basis."

Eastern Counties Gas Managers' Association.—We learn from the Hon. Secretary of the Association (Mr. T. A. Guyatt, of Ely) that the next meeting will be held at Gravesend on the 26th inst., under the presidency of Mr. J. Davis, the Engineer and Manager of the Gravesend Gas Company.

Gas from Straw.—Reference was made in the "Journal" last week (p. 626) to a project set on foot at Beatrice, Nebraska, for the manufacture of gas from straw, corn-cobs, &c. It appears, according to a correspondent of the "Daily Express," that the discoverer of the process is Mr. J. Russell Coults, B.A. of the M'Master University, and the son of a Cleveland Baptist minister who numbers among his flock Mr. John D. Rockefeller; and it is stated that the famous oil magnate is backing up the young man in his venture. The gas is produced in a special generator invented by Mr. W. P. Tarver, of London; and its illuminating and calorific powers are reported to be 24 candles and 660 B.Th.U. per cubic foot respectively. Beatrice is being supplied at the low rate, for the West, of 4s. 9½d. per 1000 cubic feet. The correspondent above referred to states that it is intended to build and operate plants in important centres of the Western States and Canada.

AMERICAN GAS INSTITUTE.

Programme for the Second Annual Meeting.

We learn from the last number to hand of the "American Gaslight Journal" that the second annual meetiug of the American Gas Institute will be held in Washington from the 16th to the 18th prox., under the presidency of Mr. Walton Clark, of Philadelphia. A full programme of papers and reports has been issued by the Secretary (Mr. J. W. Dunbar). Taking the papers first, the list is as follows:—

"Depreciation." By Dr. A. C. Humphreys.
"The Obligations Imposed by the Possession of a Franchise." By Mr. Charles H Dickey.
"Instructions for Operating Recuperative Benches." By Mr. W. A. Baehr.
"Experiments in Carbonization." By Mr. W. H. Fulweiler.
"Experience in Omaha on Delivering Uniform Candle Power to Consumers." By Mr. George H. Waring.

Reports from the following Committees will be presented: Methods of Taking Candle Power, by Mr. W. H. Gartley; Public Policy, by Mr. E. G. Cowdery; Making Rates aud an Additional System of Costs, by Mr. W. H. Gardiner; Economic Balance between Calorific Value and Candle Power, by Mr. Thos. D. Miller; Revision, by Mr. W. H. Shattuck; Electrolysis, by Mr. A. G. Glasgow; Pipe Standards, by Mr. Walton Forstall; and Uniformity of Meters, by Mr. C. H. Dickey. A communication will be submitted by the Committee of the New England Association on the subject of "Uniform Aecountiug and Depreciation;" reports will be presented from Baltimore, Philadelphia, and Savannah on "Experience with Dipping Meters;" and one from Philadelphia aud Kansas City on "'A' Meter Results." In addition to the papers and reports enumerated above, there will be a lecture on "Electrolysis," by Professor A. F. Ganz.

COLOUR IN ILLUMINATION.

Increasing interest in the colour character of artificial lights is being manifested in the field of practical illumination. The subject is from time to time referred to in papers and discussions on illumination; and it is not unusual in reporting tests of new lighting ageuts—more particularly of electric lamps—to state the predominant colour of the light given. The colour of artificial illuminants is indeed of considerable importance from several points of view. It frequently affords a different physical conception of one's surroundings to that obtained in broad daylight. The tints of pictures, wall papers, dress and other materials, are altered, although it may be in varying degree. Coloured fabrics which have been matched in daylight do not necessarily agree in hue when judged at night. Some attention was drawn to these facts by Mr. G. H. Stickney, when recently lecturing before the Illuminating Engineering Society (see "Journal," Vol. XCIX., p. 566). The subject is worth pursuing further; and some of its phases are dealt with by Mr. J. S. Dow, and Dr. Louis Bell in a recent number of the "Illuminating Engineer" magazine.

Mr. Dow anticipates that in the development of light sources we shall eventually be able to control the spectrum of our illumiuants—deciding not only the nature of the spectrum which will give the best results in illumination, but also the particular portions most serviceable for particular uses. In view of the fact that, in the wide range of present-day methods of illumination, artificial lights of varying predominant colours are obtaiuable, and that these can be modified to some extent by either chemical or physical means, there would seem to be some ground for the belief.

The probable ultimate realization of such control, however, still leaves many questions unsettled as, for instance, the nature of the illuminaut best suited for general, and also that for special purposes. It may even be a point whether the suggested ideal of artificial daylight (which virtually means prolongation of the daytime) will not indirectly cause overstrain or other trouble of the eyesight. It would seem that differences in the intensity of daylight have some effect; for a comparison of the visual acuity of men coming from different climes is said to have indicated better vision in those coming from cloudy than from sunny districts. In any case, daylight—iu character as well as intensity—has its variations. Colours compared in the light of one kind of daylight seem to be different in the light of, say, a late afternoon sun. Dr. Bell points out that the light of the sky is rich in blue rays. Daylight, as we know it—even in the full sunshine—has a bluish cast compared with sunlight, and diffused daylight by itself is strongly blue. At the present time, however, artificial daylight is not, economically speaking, easily procurable—illuminants with a preponderance of yellow light still being the cheapest to produce.

Mr. Dow draws attention to the fact that at ordinary illuminations the greatest luminous efficiency is iu the neighbourhood of the yellow of the spectrum; and he furnishes a diagram (fig. 1) showing by curves (obtained respectively by Sir William Abney and Mr. Nicholls) the distribution of illumination and energy in the solar spectrum. From this it will be seen that light rays

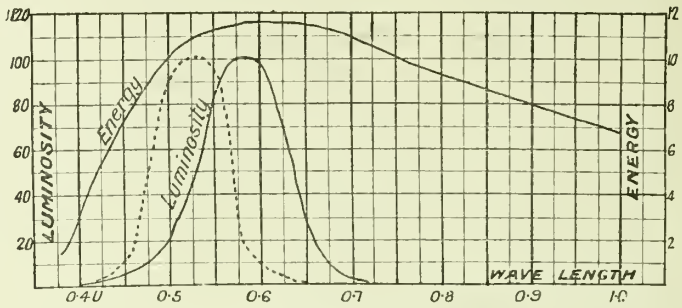


Fig. 1.—Curve Showing Distribution of Illumination and Energy in the Solar Spectrum.

starting in the dark red, attain their maximum intensity somewhere near the yellow part of the spectrum, and then diminish—finally becoming invisible at the violet end. It is supposed that the maximum of the energy curve is really in the ultra-violet; but, by reason of atmospheric filtration, the maximum of the energy distributed in the spectrum as it reaches us is in the neighbourhood of the orange and yellow.

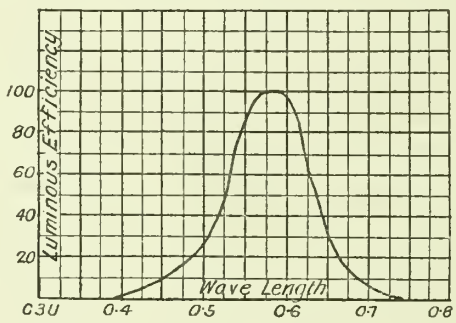


Fig. 2.—Curve of Luminous Efficiency of the Solar Spectrum.

By dividing the luminosity by the corresponding value of the energy throughout the spectrum, a curve of luminous efficiency is obtained, as plotted in fig. 2, which indicates that, for a given amount of energy reaching the eye, the greatest luminous effect produced is in the yellow. This result holds good at ordinary illuminations when the retinal "cones" of the eye are in action. When the illumination is reduced to the point at which the "rods" become the predominant organs, the distribution of luminosity is altered to the state of things shown by the dotted curve in fig. 1; and the blue and green are then the most useful portions of the spectrum.

Mr. Dow quoted, in a previous paper read before the Physical Society, M. Sartori's explauation of this physiological phenomenon. The retina contains two varieties of light-perceiving organs, known from their appearance as "rods" and "cones." The former seem to be seusitive to light, and more particularly to blue light, but cannot perceive colour—coloured lights appearing white. They are, moreover, sensitive to very weak light; but, as the illumination is increased, they become, as it were, saturated, and do uot further respond. The "cones," on the other hand, perceive colour, but are most sensitive to yellow-greeu light. While they do not respond at low illuminations, they answer to increased stimulus long after the "rods" have ceased to act. The rods and cones are unequally distributed over the retina; the latter being predominant at the "yellow spot," or the central part of the retina.

Some interesting account is given of the effect of the "yellow spot." This is very much less sensitive to the violet end of the spectrum than is the rest of the retina. The result is that with a distant object, the image of which tends to fall upon the "spot," colours on the violet side are apt to fade from sight, through loss of luminosity, much more quickly than those on the red side. From this point of view, it would seem that for the illumination of objects to be seen at a distance—as, for instance, a clock face or shop sign—green and blue would be much less satisfactory than red light.

There is another and more important factor which enters into the problem—that of the chromatic aberration of the eye. On the reception of a cone of light through the pupil, the violet rays are separated out after refraction, and brought to focus in front, while the red rays focus behind the retina. Since sunlight and artificial illumiuation contain chiefly yellow light, the retina of the eye commonly adjusts itself to yellow light and assumes a position midway between these two points. When the eye is brought very close to a small luminous white object, it becomes easier to accommodate for violet than for red; and the white object is usually seen surrounded by a red fringe. But when the eye is removed to a distance of (say) 10 feet from the object, the state of things is reversed; the violet-blue fringe, however, being with difficulty seen in consequence of the low luminosity. This property of the eye has an important influence on its power of observing detail, and Mr. Dow sums up with the remark that the blue-green end of the spectrum appears to be somewhat advan-

tageous for very close work, but very bad for the illumination of objects to be distinguished at a distance.

Mr. Dow says that, on physiological grounds, one would suppose that the spectrum of our illuminants should be made as close to that of sunlight as possible. The eyes have for countless generations been adapted to the best use of sunlight; and it seems therefore possible that injurious results might follow the use of an excess of such coloured light as red or violet, which we are accustomed to receive in small quantity. There is, however, some difference of opinion as to how the physiological influence of different portions of the spectrum really differs. The dangerous influence of the ultra-violet light is admitted; and the violet rays may, to a less degree, come into the same class, as suggested by Dr. Seabrook in discussing Mr. Stickney's lecture (*ante*, p. 566). Mr. Dow further states that there is a general impression (with which he agrees) that red coloured light is in some way stimulating and irritating, while blue light is soothing. But he has been unable to find any scientific experiments supporting the theory. Dr. Steinmetz, in a paper recently delivered before the Illuminating Engineering Society, suggested that red rays were more trying to the eyes on account of the fact that, in the case of artificial illuminants, the energy (and therefore the heating effect) were greatest in this portion of the spectrum. The action is much less if green and blue rays are in evidence. Mr. Dow's experiments, however, failed to show any marked difference in the behaviour of the pupil orifice under the influence of red and green light. Apart from Mr. Dow's tests, it is interesting to note that Dr. Steinmetz three or four years back spoke of the harmful physiological effects of light, actually observed when working for a long time with artificial illumination, being due to the red and orange rays which predominate in the artificial illuminant; and he stated that the harmful effects disappeared on the exclusion of these rays.

It would seem generally that in artificial as in natura illumination excess should be avoided in the use of strong violet and red rays, which verge respectively on to either end of the spectrum. It is probable, indeed, although to a much less degree, that excess in any one colour is a mistake, if Dr. P. Fridenberg's opinion, as expressed some time back to the Illuminating Engineering Society, is correct. He remarked that if the eye is constantly exposed to one form of light in primary colours, one set of fibres, responding to that wave-length, is irritated; whereas in the case of white light, all the fibres are stimulated. Generally speaking, as Dr. Steinmetz once stated, people have become educated to require as close an approach to daylight as possible. The problem then is to find a light which gives spectrum-lines over the whole visible range distributed approximately in the same manner as the intensity of the solar spectrum, and giving as few lines as possible outside the visible spectrum.

The search, however, for an illuminant which will exactly agree with ideal diffused daylight may after all be an unnecessary one; and an approximation thereto—allowing for the economical use of the more luminous colours of the spectrum—may yet prove comparatively harmless.

The London Gas Industry.

Following up the article on the accounts of the London Gas Companies which was reproduced in the "JOURNAL" a fortnight ago (p. 585), the "Joint Stock Companies' Journal" deals in the current issue with the statistics of the three London and five of the Suburban Companies (Brentford, Croydon, South Suburban, Tottenham, and West Ham) for the past half year, in comparison with the corresponding periods of 1905 and 1906. It is explained that the special design in making the analyses is to produce evidence of the variation of circumstances attending the operations of these Companies, and, in a degree, of all gas companies. Of these conditions, the most important of all is undoubtedly, as the writer remarks, "the growth in the consumption of gas by private users, and the maintenance of the quantity supplied for public lighting, &c.;" and the fact is emphasized that from this strongly progressive tendency have arisen "perceptible advantages to consumers and suppliers alike." The chief points brought out in the analyses are for the most part of a satisfactory nature. The expansion of sales, the reduction of manufacturing charges (apart from raw materials), the combination in regard to profits of enlarged totals with smaller averages per 1000 cubic feet of gas sold, the cheapening of administrative expenses on the latter basis, the greater productivity of residuals, and the reduction of the capital employed per 1000 cubic feet sold per annum, are all good features, mostly the effect of the increased sales. The "fly in the amber" is the heavier charge for raw material, principally coal, which it may be reasonably expected will cause a reduction of earnings in the immediate future. At the same time, the writer considers that there is the fullest reason to suppose that the multitude of people who have adopted gas lighting will continue to grow, to the benefit of the gas companies and their customers, who, as the consumption develops, "will gradually find that gas is a cheap and cheapening necessary of comfortable existence."

Mr. William Evans, J.P., of Kenilworth, one of the Directors of the South Staffordshire Water-Works Company, who died in July last, left estate of the gross value of £103,812.

A NEW COMPARISON PHOTOMETER.

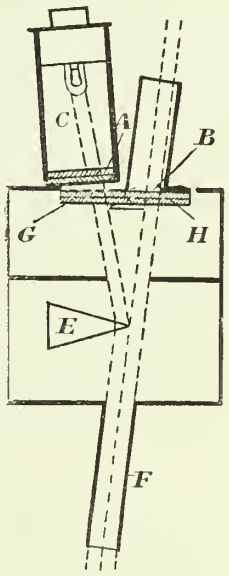
By Dr. CHARLES H. WILLIAMS.

[A Paper read before the Illuminating Engineering Society at their Boston Meeting.]

The object of this photometer is to provide a compact and portable instrument for measuring in foot-candles or other units the light reflected from surfaces, such as the walls of a room, the paper on a desk, &c., in order to determine whether one method of lighting is better than another, whether school-rooms are properly lighted, and to measure the light reflected from an illuminated surface as compared with a standard illumination.

The principle of the photometer is as follows: The object to be measured is looked at directly through a semicircular opening in the photometer. Through another similar opening the light from a small electric lamp attached to the photometer is brought by means of a prism in such a direction that the eye sees a disc of light, the right half of which comes from the object to be tested and the left half from the photometer lamp. If the intensity of the two halves is equal, it shows that the intensity of the illumination due to the object and the standard are equal. If they are unlike, the intensity is reduced on one side by means of a movable photographic film of gradually increasing density, until the two halves of the field are equal. The scale on the film gives the illumination due to the object as compared with the standard.

As will be seen by the accompanying illustration, the photometer is a small thin metal box, 3 inches square and 1 inch deep. At A and B are the two semicircular openings in the box. Over the opening A is a closed tube containing at its farther end a small tipless 5-volt lamp, and at the other end near the opening a piece of fine ground glass. E is the prism, and F the tube through which the light and object are seen. G and H are strips of glass, about 6 inches long by 1 inch wide, carrying the photographic films, which can be moved vertically before each opening, so that the light can be made more or less intense at will. On the handle supporting the box is a contact device, so that the thumb can light the photometer lamp when a measurement is to be made; the current being supplied by a small storage battery.



To use the instrument, it is first compared with some standard lamp placed at such a distance from a piece of rough white Bristol board that the surface of the board receives an illumination of 1 foot-candle. The photometer now has the photographic film before the opening H placed at zero, so that no light is absorbed by this film; and the other film before the opening G is moved up and down before the opening until both halves of the field, as seen in the tube F, are equal. The lamp of the photometer is then giving on the ground glass an illumination equal to 1 foot-candle of illumination as viewed by the photometer.

In order to measure the illumination of objects in the room, such as the light reflected from the walls, &c., we leave the film at G unchanged in position, and while looking at the object through the film H we move this film until the two halves of the field are again equal, and read off, from a scale attached to the film, its position, and from a calibrated chart we can then get the intensity of the illumination of the object looked at in foot-candles. If the object to be tested has an illumination of less than 1 foot-caudle, we leave the film H at zero, move the film G to a position of less density until the field is equalized, and then read from the scale the position of the film to get the fractions of 1-foot candle of illumination.

After all the measurements are finished, we again test the photometer by comparing it with the original source of standard light—the film H being at zero. If we find the same position of the film G that was found in the first setting before the measurements were begun equalizes the two halves of the field, it proves that the comparison lamp of the photometer has not varied in its intensity, and this checks up the photometer both at the beginning and at the end of the measurements in a way that is not easily done with other instruments. With a storage battery of about 5 volts and a small tipless lamp of the same voltage, we get a light which is sufficiently steady for an ordinary test.

In all comparisons of daylight and artificial light, and with light reflected from different sources, we often get a troublesome difference in colour in the two halves of the field. This can, to some extent, be helped by placing a light blue glass in addition to the ground glass in the tube C before the comparison lamp. But it is surprising to see how quickly and with what small errors the setting of the films can be made to give an equalization of the two halves of the field, even with differences in colour; and this is helped somewhat by the fact that these photographic films are neutral and non-selective in their effect on colours.

THE OXY-GAS LIGHT AND THE MANUFACTURE OF OXYGEN.

A paper describing the modern method for the manufacture of oxygen from the atmosphere and the use of the gas as an aid to the production of efficient lighting units from coal gas, read at the last meeting of the Austro-Hungarian Association of Gas and Water Engineers, was printed in a recent issue of "Gas-techniker," the author being Herr Hansmann.

Herr Hansmann began his communication by sketching the earlier chemical methods for preparing oxygen in quantity, pointing out that they were not commercially successful, and that therefore illuminants like Drummond's lime light (which was invented in the year 1825) had never really become successful except for certain small and specialized purposes. When, however, the later experiments on the liquefaction of air showed that oxygen could be recovered in a state of purity by fractional distillation of the liquid, it became technically and economically possible to use oxygen in conjunction with coal gas for the general purposes of lighting.

At the present time oxygen is made in the following way: Air is freed from moisture and carbon dioxide and raised to a pressure of (say) 200 atmospheres. It is then caused to enter one of three coiled tubes of narrow bore which are surrounded by a common jacket. The tube in question soon increases in diameter, and communicates with a reducing valve which leads the air into collecting vessels, whence it passes backwards through the jacket already mentioned. The expansion of the air causes a reduction in its temperature, which is transmitted to the further quantities which are travelling through the coil. On repeating this process several times, the temperature of the air is continuously reduced until it finally reaches a point where liquefaction occurs. The liquid air next passes to a fractionating column, trickling down through a number of sieves or a thick layer of glass beads. In these circumstances, much of the nitrogen and a small quantity of the oxygen volatilize; the gaseous product being caused to encounter the liquid air on its entry into the column so as to evaporate more of the nitrogen and condense more of the oxygen. Hence the liquid which collects in the final receiver of the apparatus is fairly pure liquid oxygen. The liquid is allowed to evaporate once more, and is caused to pass through the inner tube of the coils, thus, like the cooled gaseous nitrogen, serving to remove part of the heat from the original compressed air. The apparatus in general is so constructed as to prevent access of heat to the utmost extent possible; but in spite of the most perfect insulation, so much heat enters it by conduction and radiation that fresh work has to be done upon the air in the form of compression throughout the whole process.

The Oxy-Gas Light.

The first burner in which oxygen was successfully used in conjunction with a gas-flame with the object of evolving light was invented by Herr Nürnberg, of Berlin, in 1904. The essential feature of the apparatus was that the jacketing tube was provided with an elbow, so that the oxygen met with some resistance during its passage to the flame, was diverted from its original direction, and impinged upon the stream of gas at a sharp angle. This arrangement not only led to more perfect mixing of the gas, but also kept the flame away from that part of the burner which would otherwise suffer most from heat. The original burner has since been modified in a great many ways; but the crooked oxygen tube is still found indispensable. Nürnberg originally designed a common cock for the control of the two gases, having a plug with two holes and one single casing. The appliance had the defect of not being part of the burner, so that certain joints had to be made by brazing. Latterly, a more practical apparatus has been designed, which is arranged concentrically with the burner and fitted with a vertical plug. The last form of combined cock is easy to manufacture and more satisfactory to use.

The first "Nürnberg" burner developed light at the rate of one Hefner unit per 0·7 litre—*i.e.*, 36·8 candles per cubic foot when in good condition—but it has now been so far improved as to yield on an average 51·5 candles per cubic foot. In certain cases, indeed, its illuminating power has been equal to 73·5 candles per cubic foot, with a maximum value of 107. Nürnberg burners are now being manufactured in different sizes, and show the following illuminating powers and duties:—

Size of Burner.	Illuminating Power.	Consumption in Cubic Feet.	
Mm. Inch.	Candles.	Coal Gas.	Oxygen.
6 = 0·24	109	1·06	0·88
8 = 0·31	227	1·98	1·98
12 = 0·47	364–455	3·5–4·25	3·5–4·25
19 = 0·75	1090	8·85	8·85
28 = 1·10	1820	14·1	14·1
35 = 1·40	2730–3640	24 8–28·2	24·8–28·2

The Cost of the Light.

Herr Hansmann next proceeded to deal with the cost of the oxy-gas or "Nürnberg" light in comparison with ordinary incandescent coal gas, on the assumption that one litre of gas burnt in conjunction with an equal volume of oxygen developed light at the rate of two Hefners per litre, and that the ordinary incandescent gas-burner afforded 100 Hefners per 140 litres, or 18·6 candle power per cubic foot. The speaker founded his calculations on the basis (translating his metric data into English figures) that 1060 cubic feet of coal gas could be made from 220 lbs. of coal by means of the heat evolved during the combustion of 35 lbs. of coke, a quantity which would generate sufficient energy to yield 281 cubic feet of oxygen in a factory of roughly equivalent capacity to the coal gas-works, which was supposed to be of "medium" size. As oxygen did not burn, but required an equal volume of coal gas to be used with it, it was necessary in calculating to add 281 cubic feet of coal gas to both sides of the equation; whence it appeared that (1060 + 281 =) 1341 cubic feet of coal gas consumed by itself in an ordinary incandescent burner would afford approximately 27,000 Hefners, whereas 281 feet of coal gas consumed with 281 feet of oxygen would afford 32,000 Hefners. It was also necessary to understand that the cost of generating oxygen decreased much more rapidly with every increase in the amount produced than did the cost of making coal gas; for while the amount of energy consumed in preparing oxygen from the atmosphere might fall from 4 to 1½ H.P. hours per cubic metre, as the operation was conducted on a larger scale, the quantity of coke used in carbonizing coal would only fall from 18 to 12 per cent. by weight of the coal consumed.

At the prices ruling in Austria, Herr Hansmann estimated that the actual working costs of producing oxygen were about 3s. 1d. per 1000 cubic feet; so that if an addition of 75 per cent. were made to them for depreciation, interest, &c., the total manufacturing costs might be said to be about 5s. 4d., which would allow the gas to be sold at about 7s. per 1000. If ordinary coal gas were sold at 4s. 9d. per 1000 cubic feet, the data already given showed that 100 Hefners could be developed in the Nürnberg burner for a cost of 0·125d., whereas a similar quantity of light produced by the Welsbach incandescent burner would cost 0·28d. The capital cost of erecting a factory for providing Nürnberg light over a district—*i.e.*, a combined coal gas and oxygen works—was naturally higher than that required in the construction of a simple coal gas-works; but the double main did not involve so great an additional outlay as might be thought. Indeed, the author stated that for a given number of lights the capital cost of a Nürnberg factory would be 1·2 units of money if the cost of a gas-works were one unit. The Nürnberg factory, too, would appeal to many consumers for whose purposes a supply of ordinary coal gas would not suffice, inasmuch as the supply both of gas and of oxygen would enable the autogenous soldering of metals to be carried out—a process that was constantly growing in importance.

The Explosion of Gases.

The current number of "Nature" contains an interesting illustrated article on the above subject, signed by "L. B." The author points out that the earliest work on the explosion of gases was that of Sir Humphry Davy, who in 1817 published the results of the celebrated experiments on "the propagation of flame through small tubes and orifices" which led to the construction of the miner's safety-lamp. More than fifty years later, Bunsen devised the non-luminous gas-burner; observing that unless the flow of the mixture of coal gas and air exceeded a certain rate, the flame became unsteady and passed down the tube. In 1881, Berthelot and Vieille discovered that when an explosive mixture is ignited at the end of a long pipe, the velocity of the explosion rapidly increases from its point of origin until it reaches a maximum velocity, which remains constant however long the column of gas may be, and which greatly exceeds the speeds of combustion measured by Bunsen. This discovery was confirmed by the independent investigations of MM. Mallard and Le Chatelier. The velocity of the explosion wave constitutes a physical constant which has a specific value for each inflammable mixture; and measurements made by Berthelot and by Professor Harold B. Dixon have shown that it is approximately equal to the velocity of sound in the burning gases at the temperature of the explosion. For a mixture of hydrogen and oxygen in equivalent proportions, it is about 3000 yards a second. Le Chatelier's apparatus was not fast enough to analyze the wave of detonation itself. By apparatus devised by Professor Dixon, however, some interesting and important experiments have been carried out by him in conjunction with Mr. Bradshaw; and these and cognate matters are the subject of the article under notice.

In recent issues of "Stahl und Eisen," Herr H. Dicke discusses the use of water gas for welding purposes, and describes and illustrates the Dellwik-Fleischer plant for the generation of this gas. According to a notice of the articles in the Engineering Supplement to "The Times," the arrangement of the apparatus is shown by diagrams; and numerous examples are given of the welds carried out by means of water gas. Certain modifications in the process are explained, and the use of the gas for various industrial purposes and for the manufacture of steel are described. An account is also given of the value of the gas and of "blue" water gas for the production of power by gas-engines.

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

General Meeting at Shrewsbury.

The paths of Gas Associations often lie in pleasant places; but they can seldom do so in a more pleasant one than did that of the Wales and Monmouthshire District Institution of Gas Engineers and Managers last week. To explain this, it is only necessary to say that the meeting took place at Shrewsbury, a town which possesses many features to interest those who visit it. Speaking as an ordinary visitor, one might hesitate whether to place first in this category the many charming old buildings to be seen, or the delightful views embracing the River Severn, which, of course, almost surrounds the town. For the gas engineer there is a third attraction which may, if the time at his disposal is limited, leave him little opportunity of judging of the others. This, it is almost needless to mention, is the new works erected by Messrs. R. Dempster and Sons, of Elland, for the Shrewsbury Gas Company in 1903, which readers will remember were fully described in the "Journal" at the time. Like the town for whose needs in the matter of light, heat, and power they cater, the Gas Company have a history—and an excellent history it is. A progressive policy has met with the success which it deserves—and usually obtains; and in spite of the competition of electricity—if not actually because of it—the consumption of gas goes on steadily increasing in a most satisfactory manner. Hence it was that, some years back, the site on which the old works stand being "full up," the idea was adopted of putting up entirely new works on ground belonging to the Company a short distance away—a block of buildings, in fact, separates the two works. Except at the busiest season of the year, all the gas is now made at the new works, which, of course, are of quite an up-to-date character, and have been arranged with a view to extensions which will double the output, as soon as the demand necessitates them being carried out. It is not to be wondered at that both the Board and their Engineer, Mr. William Belton, are proud of these new works, seeing that the results attained have been even better than was anticipated when they were erected. Attentive as the Company are to the manufacturing side of the business, it may be pointed out that they are not less careful in regard to the sales department, for in the very heart of the town there is a show-room, where may be seen a varied selection of tasteful appliances for the utilization of gas. The offices themselves adjoin the old works; and it was in the Board-room there that the members of the Association met last Wednesday afternoon, and were received by Mr. Belton, on behalf of the Directors of the Company, none of whom unfortunately were able to be present. They had, however, left the matter in safe hands; for Mr. Belton's welcome was of the warmest, while he subsequently accompanied the members round the works and explained the various features to them. The inspection was preceded by the reading of a short descriptive paper by Mr. A. W. Elliott, the Assistant Manager, who also accompanied the party in their tour. As to the affairs of the Association, after a successful year of office, Mr. R. A. Browning, of Neath, vacated the chair in favour of Mr. Edward Jones, who has removed from Pontypridd to Burslem—a fact which led him at a later stage to suggest that the next meeting should be at Cardiff, to which proposal the members agreed. He also gave notice of motion that the Committee should consider the advisability of changing the date of the autumn meeting to the last week in September or the first in October—it having been pointed out to him that the present date is so near the holiday season as to be rather inconvenient to the members. Mr. Jones's principal duty in the chair, however, was the delivery of his Presidential Address, which was followed with the closest attention by those present, and, as Mr. Hubert Pooley remarked, gave the members ample matter for consideration. The *agenda* also included a paper by Mr. J. H. Canning, entitled "Some Notes on the New Electric Lamps." Mr. Canning, however, was not present, and so it was taken as read, and the discussion adjourned until the next meeting. This will give members plenty of opportunity to study what the author has to say; and the result should certainly be a good discussion. With the formal business, the address, and Mr. Elliott's paper, the time available for the meeting was fully occupied; and the inspection of the works and the subsequent entertainment of the members at meat tea, brought to a close a day which, it is quite safe to say, was thoroughly enjoyed by all those who were able to be present.

The Half-Yearly Meeting of the Institution was held at the Gas Offices, Shrewsbury, last Wednesday; and the members were thus afforded an opportunity of inspecting the new works which were erected in 1903, and which were at the time fully described and illustrated in the "Journal"—see the issues for July 7 and Dec. 15, 1903. At the beginning of the proceedings, the chair was occupied by Mr. R. A. Browning, Assoc.M.Inst.C.E., of Neath, the Retiring President. Subsequently, however, he gave place to Mr. Edward Jones, of Burslem, the President-Elect.

A Welcome to Shrewsbury.

The Retiring President remarked that, before starting on the *agenda*, he must introduce to the members Mr. William Belton, the Engineer, Secretary, and Manager of the Shrewsbury Gas Company, who wished to say a few words.

Mr. Belton said that, on behalf of his Directors, he had to express great regret that various circumstances had prevented the attendance of any of them there that day; but he had to offer the Association a very hearty welcome to Shrewsbury in their name. They trusted the members would have a most successful meeting, and would see in the gas-works something to please them. For himself, he was proud to have the pleasure of meeting those present; and, though it was not for him to boast, he thought the members would find they had at Shrewsbury a section of a new works as up-to-date as anything that was to be seen. These new works were giving splendid results—in fact, they had done even better than was anticipated when they were put down; and those connected with the Company had every reason to be satisfied with their arrangement and with the work accomplished. They reflected great credit on Messrs. R. Dempster and Sons, of Elland, who built the whole works complete, from end to end.

Minutes of the Last Meeting.

The Hon. Secretary (Mr. Octavius Thomas, of Pentre) then read the minutes of the meeting held at Neath in May last; and they were confirmed.

New Members.

The following were elected members of the Association: Mr. Alfred E. Williams, of the Grangetown Gas-Works, Cardiff; Mr. James A. Boucher, of the Llynvi Valley Gas Company; Mr. Leonard G. Hall, of the Rhyl Gas-Works; Mr. W. E. Brock, of the Denbigh Gas-Works.

Introduction of the New President.

The Retiring President remarked that the next item on the *agenda* was a very pleasing one—the introduction of the President-Elect, Mr. Edward Jones. Of course, he said, Mr. Jones was so well known to them in South Wales that no words of his (Mr. Browning's) were necessary. They were very sorry to lose him from their district; but no doubt he had gone to a better place—for which all were on the look out. Mr. Jones came before them as a well-tried man. He belonged to the Council of the Gas Institution, and was a past-master in all things of that kind; and no doubt he would bring his experience to bear on his appointment as President of the Wales and Monmouthshire Institution in a way that would be of benefit to them. The affairs of the Institution would be safe in his hands; and therefore he was very pleased at his election. He would like to say, before he vacated the chair, that, whoever they had to fill the office of President, they were greatly indebted to Mr. Octavius Thomas, the Hon. Secretary. He, personally, could only say that he had experienced unusual kindness from him. Mr. Thomas was so attentive to every detail, that it left very little for the President to do. He was sure that every President on vacating the office would reiterate what he had said, and praise Mr. Thomas for his kindness and the way he carried out his duties. He concluded by wishing Mr. Jones a prosperous and happy year of office.

The Retiring President Thanked.

The President then took the chair, and returned thanks for the kindly welcome given him as President-Elect, and now as President of the Association. The first duty he had to perform in the occupancy of the chair was, he said, a pleasing one—namely, to propose a hearty vote of thanks to the Retiring President. Mr. Browning, he thought they would remember, entered upon his duties as President of the Association with somewhat of a dubious air; but he seemed to get at once the zealousness and the earnestness of their first President, Alderman Thomas Canning—which he himself said he was going to copy. They all knew how hard he had worked for the Association during the past year, and how ably he had fulfilled the duties of his office. As to their Hon. Secretary, he (Mr. Jones) certainly endorsed every word that Mr. Browning had said. Mr. Thomas had been, and still was,

the moving spirit in the Association. The area covered by their Society was a wide one; and naturally, of course, it was difficult to get such attendances of members as they would like. Personally, he felt very much indebted to those who had come so far as Shrewsbury—though Shrewsbury was one of those towns with regard to which distance was a secondary consideration, in view of its natural beauty and historical interest. He had great pleasure in proposing a very hearty vote of thanks to Mr. Browning for the manner in which he had occupied the chair of the Association during the past year.

Mr. A. H. Brookman (Tenby), in seconding, endorsed every word the President had said in Mr. Browning's favour.

The motion having been carried by acclamation,

Mr. Browning, in returning thanks, said that, as time was short, he would not inflict a long speech upon them. He considered that any man who accepted such an office should try to do his best.

THE PRESIDENTIAL ADDRESS.

The President then read his Inaugural Address, in the course of which he said:

Gentlemen,—Allow me first to express my sincere gratitude for the high honour you have thought fit to confer in electing me President—a position which I felt somewhat diffident in accepting in view of my removal from the area of the Association. It was only my sense of loyalty, and the assurance of your forbearance, co-operation, and kindly expressions that induced me to accept; and I must confess that I feel the responsibility attached to the position—more especially in view of the fact that as a young Association much is required to maintain the high-water mark of my predecessors.

In the preparation of an address, I am sensible that I cannot say anything new or of extraordinary interest, in view of the multiplicity of gas and kindred technical institutions that, in the course of the year, are each called upon to hand down to posterity an introductory address. Light, heat, power, and residuals all have their rivals; and it behoves us to rise and work hand in hand to uphold and maintain the prestige that has been ours so long. Colliery proprietors and other bodies have their Associations, and meet their representatives in a body, in order to deal with labour questions—both rates and hours. Gas companies and authorities on the other hand have to meet individual attacks single-handed, although I admit that co-operation would be difficult, as no two works are exactly alike, and in the end a great deal would have to be left to the tact, judgment, and discretion of the individual. But admitting these difficulties, I contend that an Association with statistics and information as to its area would be invaluable, and one could draw from its stock on subjects relating to questions which come within its scope—not only regarding labour, but as to matters of commercial importance, such as the value of coals, the markets for coke and sulphate, and the many attacks made upon gas as a heating and lighting agent.

The Gas Institution and the District Gas Associations have undoubtedly been formed for dealing with the manufacture and distribution of gas, and not with commercial and labour questions. But the Manchester District Institution and other Gas Associations have made a success of their Commercial Sections; and if such a Board could be formed by us I feel sure the various organizations which have done good work would welcome debate of a general character rather than spasmodic attacks upon isolated places. I am satisfied if anything can be done in this respect, it would be unwise to prejudice the technical part which has done and is doing good work.

Looking at the expenditure account, we find the item which occupies usually the first column, "Coal and expenses thereon," one which has more or less agitated the minds of managers throughout the kingdom during the past year. With the prospects of better trade we are met with a corresponding advance in materials. Coal, the staple and root of our business, has been advanced 25 to 30 per cent., necessitating in many instances an advance in the price of gas. The coal question has pre-eminently occupied the first place at the annual meetings of gas authorities and companies; and no doubt every member has carefully noted the valuable expressions and opinions given at these times by such eminent men as Sir George Livesey and Mr. Corbet Woodall. It will be some little consolation to those who have sailed so close to the wind in their profits as to make it necessary to advance the price of gas; and while the sting is in we ought to take advantage of our position to increase our day-load by pushing the use of gas for cooking, heating, and motive power.

We shall await with some anxiety the proposed Eight-Hours Miners Bill, which is being pushed along vigorously, and which, if passed, will, it is alleged, increase the cost of getting coal, so that there is every prospect of yet dearer coal in the future. The gas industry, which has an annual consumption of 15 million tons, will feel the strain; but we must not forget that the general users of coal will also suffer, although as Sir George Livesey has pointed out the Eight-Hours Committee have advised Parliament not to neglect the interests of the great bulk of the people.

We have long accepted the truism that money is made or lost in the retort-house. Therefore an address could not be complete without a reference to this all-important question. My experience has thrown me in contact with various classes of fuel, and also various methods of manufacturing in different parts of the country; and I may be pardoned if I rehearse what perhaps you already know, and only await the opportunity to put in practice. We all acknowledge the splendid services of Sir George Livesey and his *confrères*, who have broken down the barriers of providing a high candle power gas; and in no part of the country is this more appreciated than in the area of our Association. While steam coal of world-wide reputation abounds in our midst, I venture to say the gas coal is not worthy of the name, compared with the qualities supplied in most parts of England. Consequently, our results, which are excellent from the material at hand, would be considered very inferior; and in this particular alone the benefit of our Association is of the utmost importance. In South Wales, I used to look upon 10,000 cubic feet of gas per ton of coal carbonized as an ideal; now I look upon 12,000 feet as a prospective yield, and an average rate per ton of 11,700 feet may be regarded as an approach to this. I have always supported high heats and long-duration charges; and my experience convinces me that if we are to cheapen our gas, we shall have to resort more towards coke-oven principles. With the advent of low-grade gas, the development and increase of incandescent lighting, and the demand for "Coalite" or its substitutes, I fail to see why we should consider the contentious question of unaccounted-for gas as being the all-important and ruling question in the management of our concerns. It is a problem that we have yet to solve.

Within a stone's throw of the Burslem Gas-Works, are chemical works carbonizing coal in inclined retorts, with no regard to the gas. They are working continuously, with a constant output of coke—thereby reducing the market value. The bye-products however are sufficiently remunerative to permit them to continue working with plant similar in all particulars (save gasholders) to that in use in our gas-works. The development of the bye-product coking industry and the low cost of production, as was shown in the valuable papers on the subject submitted to the last meeting of the Institution of Gas Engineers, lead me to anticipate that engineers will not allow this matter to rest, but will satisfy themselves that, with improvements in carbonizing, we may at least employ our surplus producing capacity to some monetary advantage.

The aim of every works is to sell gas at the lowest price; and this is best done where the capital is uniformly employed throughout the year. Though few of us are privileged to wipe out the old and begin *de novo*, still, with extending business, we can do much in looking forward and arranging to use methods which result in obtaining gas at the lowest cost per 1000 cubic feet. Never was our industry in greater need of the distribution of a low-cost gas than at present, and no manager can afford to neglect details, however small his works. It has not been my privilege to lay down any extensive new system, but rather to accept and extend; and during my last two appointments the works were practically new.

The general methods of carbonization before us now are: 1st, horizontal retorts, with hand labour; 2nd, horizontals, machine charged and hand-drawn; 3rd, horizontals, machine charged and drawn; 4th, inclined retorts, with machinery; 5th, vertical retorts, with machinery; and I may add a sixth or a go-between—the vertical and the inclined. The cost of carbonizing varies in each works with the local conditions, and is governed by materials and labour. But the difference in cost between hand-charging without machines and inclined retorts or machinery is such that no one can hesitate to accept the responsibility of advising machinery or the inclined system.

The Burslem retort-house is in three sections. The first has four beds of nine horizontal retorts, 20 feet through, with hand charging. The second has four beds of similar sizes. The third has five beds of eight inclined retorts, 20 feet long. As these beds work independently during the summer, I will give you the cost in each case per ton of coal and per 1000 cubic feet of gas made.

Horizontals, Full-Depth Regenerative Settings of Nine.

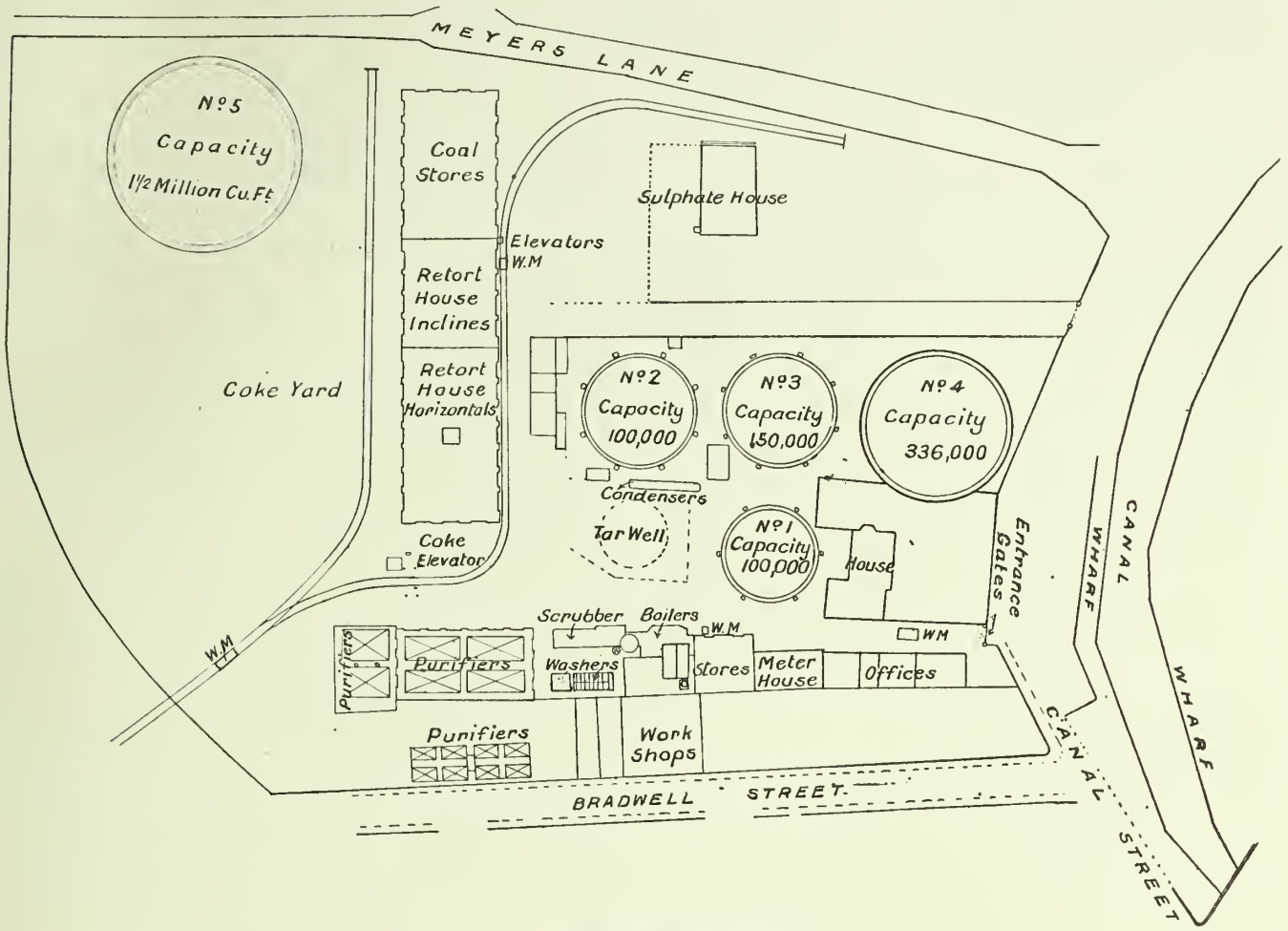
[Included in the cost of carbonization: Half foreman's wages, two-thirds exhauster man, leading stokers, stokers, cokers and coal wheelers, pipe-jumpers, &c. Time-and-half is paid for Sunday work.]

Retorts: Three beds of nines, 20 feet through = 27 retorts working
Number of charges, 1512. [six-hour charges.
Make of gas, 6,356,000 cubic feet.
Make per ton of coal carbonized, 11,814 cubic feet.
Make per retort, 16,816 cubic feet.
Coal carbonized, 538 tons.
Coal per retort per charge, 7'12 cwt.
Cost of carbonization, £84 1s 2d.
Do. per 1000, 3'18d.
Do. per ton of coal carbonized, 3s. 1'5d.
Men required for each shift—12 hours: 1 leading stoker, 5 stokers, 3 cokers and coal wheelers, 1 pipe-jumper.

Inclined Retorts with the Usual Machinery, Regenerative Settings of Eights.

[Included in the cost of carbonization: Half foreman's wages, two-thirds exhauster man, leading stokers, stokers (charging), stokers (drawing side), coke wheelers, &c., elevator, and engine man. Time-and-half is paid for Sunday work.]

Retorts: Five beds of eights, 20 feet through = 40 retorts, working
Number of charges, 1880. [eight-hour charges.
Four days working on six-hour charges.
Ten days working on eight-hour charges.
Make of gas, 7,102,000 cubic feet.
Make of gas per ton of coal carbonized, 11,681 cubic feet.
Make of gas per retort, 12,682 cubic feet.
Coal carbonized, 608 tons.
Coal per charge, 6'47 cwt.
Cost of carbonization, £56 2s. 6d.
Do. per 1000 cubic feet, 1'9d.
Do. per ton of coal, 1s. 10'1d.



Plan of the Burslem Corporation Gas-Works.

The above cost includes all charges from the unloading of the coal from the trucks to the loading of coke into trucks. On eight-hour charges the men employed on each shift are: 1 leading stoker, 1 stoker (charging), 1 stoker (drawing), 1 coker, 2 elevator men, employed part time.

The conditions of working are identical in each case with respect to heats; and a hydraulic governor is placed upon each bench. The mode of working, though not new, may be of interest, as the make per ton at times tops 12,000 cubic feet without enrichment, and a good 15-candle power gas is supplied.

The plan shows the general construction. The coal siding is on the right side and the coke siding on the left. The inclined retort house has five settings of eights, 20 feet long. The coal is elevated to overhead bunkers over the retorts. The whole of the machinery, coal elevator, and conveyors are worked by a 12 H.P. gas-engine. The coke is deposited into large barrows and wheeled some 6 yards, slaked, and forked direct into the trucks, as will be readily seen by the plan. No coke conveyor is necessary.

The materials used are washed nuts and beans. Each retort holds 7½ to 8 cwt. Each bed has a separate hydraulic main, with the usual tar-main and flushing arrangement. There is also fixed to each a 2-inch main with a separate cock to fill with liquor from an overhead tank pumped from the well.

The method of working is: Before drawing the retorts, the hydraulic mains or boxes are filled with liquor, giving a 1-inch seal; and after the end of the charge the boxes emptied, and the whole of the contents returned to the well. Between the charges we work with a dry main. I have brought with me a diagram which shows the conditions at the exhaust and hydraulic main side of the governor.

I am repeatedly having inquiries relating to the working merits of these governors. My opinion is that they are essential in every retort-house; my only regret being that I did not instal them years ago. I should then have been spared a considerable amount of anxiety, especially when using dry mains. No matter how reliable the exhaust governor may be, there is always a risk; and the foreman in his anxiety to recover lost ground is often tempted to sacrifice the candle power of the gas for the make—a state of things the manager is not aware of until the hours of lighting are on. With the hydraulic governor, this is impossible; and no matter what the vagaries of the exhauster, steam, or aught else may be, the governor refuses to budge.

I find the best results are secured with a vacuum on the governor of 3 inches. The exhauster diagram shown may be considered erratic, and one can better imagine than describe the doubt and suspicions of the qualities of gas upon an examination of the chart in the morning, if this alone were used. The regularity of the exhaust line is in my opinion a remedy for stopped pipes with an increased make and a maintenance of a uniform candle power.

Just a word as to flushing. My experience at the Treforest Gas-Works convinced me of the absolute necessity of continuous flushing. The slightest neglect meant, not only stopped pipes, but blocked mains. I admit I worked high heats. But the class of coal demanded it; and though I continue to work high heats, the adoption of the flushing is the cure. The difficulty to face was the raising of the temperature in the liquor well, which was likely to, and did affect, my sulphate returns. I therefore diverted the liquor to a cooler, composed of a length of 12-inch pipes, and through two old boilers which are used as separators so as to prevent tar going to the sulphate stills. This was effective (the overflow or surplus only going to the well, while the bulk went forward to the sulphate plant, when working), and the temperature was reduced to 60° Fahr. So effective was this that our sulphate returns for the past year were 28½ lbs. per ton of coal carbonized—being an increase of 4 lbs. per ton.

As previously explained, I was called upon to extend and not to instal; but I may say that the cost per ton of coal carbonized with hand charging at the Burslem works is such that an extension of the inclined system has been decided upon; and I hope to put down further inclined retorts in the spring. Whether vertical retorts will show such superiority in obtaining better results at a decreased cost is not yet proved; but I am satisfied that retorts set nearer to the vertical than 32° (on the lines on which Mr. G. R. Love, of Guildford, is working) are likely to produce results nearer finality than at present. The Council of the Institution of Gas Engineers are not losing sight of the importance of carbonizing, and have appointed a Committee, with power to co-opt gentlemen whose results and labours really justify their opinion; and we shall await the report of their investigations with more than common interest.

It will be remembered that I contributed to this Association in 1905 some notes on the working of the Fiddes-Aldridge stoking machine as erected at the Treforest Gas-Works; and my concluding remarks were "that the machine had justified the claims for it, and with the complement of elevating and conveying machinery would compete forcibly, in cost per ton, with other methods of carbonizing." The use of machinery and the labour saved were not acceptable to the majority of the Pontypridd Gas Committee, and they refused to instal the overhead hoppers, coal-breakers, elevators, &c., without which no beneficial results could be expected. The machine has now been remodelled, and is giving satisfaction elsewhere, as will be seen from the account published by Mr. Edward Allen, M. Inst. C.E. So satisfied is he that additional machines are now being fixed. I mention this not that I hold a brief for this particular machine over and above others that are doing equally good work. Engineers have to choose the machine that is best suited for local conditions; and the simultaneous action of the Fiddes-Aldridge plant appealed to me as the nearest approach to finality. It exactly suited my requirements at Pontypridd; and if my present retort-house was suitable for, and the conditions were right, I would not hesitate

to adopt machinery. Even a moderate sized works (say) of 50 millions, would be well-advised to consider the adoption of machinery, not only from a humanitarian point of view (to do away with the arduous task of stoking), but from a business point. Surely no one can accuse us wrongfully in cheapening the cost of production.

Before I leave the retort-house, I cannot refrain from associating naphthalene troubles with carbonization; and though it is a long cry from the ascension pipe to the distributing main, yet I have invariably found that troubles with stopped mains and pipes in the retort-house give immediate anxiety with naphthalene deposits in the outside district. A keener and more concentrated watch on the gas in its earlier stages might lead to less trouble, and ultimately avoid the very many devices that exist to prevent its appearance in the mains and services. Burslem has, with others, suffered severely in the past; and I expressed myself to the Gas Committee there as thankful in anticipation for the fact that a plant to prevent and overcome naphthalene deposits had been fixed. It is the Hastings carburation process, invented by Mr. C. E. Botley, the Engineer of the Hastings Gas Company. I have nothing but the highest praise for it—not having had a single complaint of naphthalene this year. Last year, about this period, being holiday time, I took advantage of the opportunity to strip the engine. Unfortunately, we had a sudden snap of cold; and I had some fifty complaints. I immediately got the plant to work, and have not had a single complaint since.

The process consists essentially in adding to the moving gas, on its way to the points of combustion, an exceedingly fine mist or fog produced from petroleum by means of specially designed atomizers. The carburator is merely a steel cylinder, fitted with the necessary connections, drip-wells, &c. Atomizers and sight-holes are fixed on the outlet of the governor of the town. The compressor is a 4 H.P. steam-engine, and it maintains a pressure of 70 lbs. to 80 lbs. per square inch on the compressor gauge, and 25 lbs. to 30 lbs. on the oil-cylinder gauge. The atomizers are used in accordance with the amount of gas passing through; and when at work the operation (as viewed from the sight-holes) is that the oil-jets are lost and the whole mass is a mist or fog. The amount of oil used for the year to March 31 last was 420 gallons; and the cost per 1000 cubic feet of gas sold was 0·017d.

Purification in closed vessels has not yet realized the ideal we have long anticipated and worked for, so that sulphur can be removed from the gas and, if possible, sold much in the same way as ammonia. If this is not accomplished as perfectly as we would like, engineering, new methods of working, and legislation have not been idle in other directions; and those who have been called upon to extend or renew works have realized the beneficial results both in construction and operating economies. In this connection, one must not forget the luteless purifying system introduced by Mr. Green, of Preston, with its resulting reduction of capital cost.

I do not intend taking up your time with any description of even the various improvements that have been introduced from time to time, but would like to record a little experience which may perhaps be helpful to some in the working of purifiers. The luteless purifiers admit of economies in many directions—notably in space occupied, and in reduction of lifting gear. These are items which tend to reduce the capital charges to a minimum and cheapen the cost of gas per 1000 cubic feet purified. In dispensing with roofs over the purifiers, it must be clearly understood that it is a mistake to economize by neglecting to roof the revivifying area. This is essential for the proper working of oxide, as success depends largely upon the proper preparation of the material. If exposed to the wet and containing an excess of water, purification is retarded; if in deep layers, it short-circuits—giving back-pressure which finally results in the box being thrown off and emptied before the oxide is half spent. I have had disappointments in this direction which makes the subject one of interest to me. I am aware that each engineer works his purifiers according to his ideas of what is most suitable to his particular works; and it is only by failures we are ever able to judge our successes.

It may be interesting perhaps to describe the mode of working which, in my opinion, is the most successful, having regard to cost per 1000 cubic feet and purity of gas at Burslem. The plan of purifiers is before you. Nos. 1, 2, 5, 6, 7, 8, are worked with oxide. Nos. 3 and 4 are worked alternately with lime as required. Nos. 1 and 2 (erected last year) are 35 feet by 22 feet, and hold 70 tons of oxide each. They are luteless, and are worked as shown with a travelling runaway, and buckets for charging or discharging, containing 10 cwt. each. No. 3 is charged with oxide (60 tons), which will be fully spent when taken out. No. 4 is lime. Nos. 5, 6, 7, and 8 are used as catch-boxes. The sulphur compounds are kept well within the parliamentary limit.

It may be of interest to relate the circumstances which led to the adoption of this method of working. We were accustomed to work up our oxide for sale in the first boxes, using new oxide (or that containing a low percentage of sulphur) in the last four boxes, for the purpose for removing the last traces of sulphuretted hydrogen. This procedure is dictated by the law of mass-action; but my experience has been such as to show that there are other circumstances which modify very considerably the results one would expect to obtain. The observations which I have made for some time in this connection will be well illustrated by quoting the following particular case: We charged the first box in the series with oxide partically spent, on Nov. 21, 1906. The following is the result of analysis of an average sample at the time:—

Percentage of sulphur on the dry basis	30·10
,, ,, ,, wet ,,	26·63
,, ,, moisture	11·50

This box was next changed on Jan. 21, 1907, and the amount of gas passed through during this period was 62 million cubic feet. The analysis of the oxide when taken out was surprising—

Percentage of sulphur on the dry basis	43·40
,, ,, ,, wet ,,	29·80
,, ,, moisture	31·30

You will observe that although, in the bulk, the sulphur had increased by 13·3 per cent., the percentage of increase on the wet basis was only 3·17; and this after having passed 62 million cubic feet of gas through it, contained from 500 to 600 grains of sulphuretted hydrogen per 100 cubic feet. It was then apparent to me that I should be seriously hampered both in working up the oxide for disposal and in effective purification, because to have followed out the practice of working the oxide from the last of the series successively through the series back to the first would have meant that I should have had on hand a large mass of material containing such a quantity of sulphur as to reduce its efficiency in the boxes, while not containing such a percentage of sulphur on the wet basis as would enable me to dispose of it to advantage.

The analyses of the oxide put in and taken out of the boxes gave me the key to the solution. I observed that while the percentage of moisture of the oxide in the first two boxes was always increased, the moisture in the oxide after passing through No. 3 box was always decreased. It was now evident where the secret lay. The first two boxes are in the open, and all the others are under cover. Naturally, the outside boxes are readily influenced by changes in atmospheric temperature. It should be noted that in the example I quoted, the purifier was working in the cold season of the year; and, as a consequence, a great deal of the moisture was condensed there. The gas robbed of moisture in the first two boxes, passes into the third box, which is under cover and is not subject to the same reduction of temperature as the outside boxes; and it is well known that chemical reaction takes place more readily at a temperature approximating to 60° Fahr. than at a lower temperature. This was the case. Accelerated reaction was, of course, responsible for a further increase in the temperature; and under these circumstances—the reverse of the conditions in the first boxes—evaporation took place. I then resolved to make No. 3 the finishing box, and with what success you will see from the following tests:—

Analysis of Oxide when put in No. 3 Box on Nov. 10, 1906.

Percentage of sulphur on the dry basis	43·4
,, ,, ,, wet ,,	29·8
,, moisture	31·3

This was the oxide which was taken from No. 1 box. The figures are most interesting because it cannot be said that the physical character of the oxide was the cause of the different results as might have been said if different lots of oxide had been used. The oxide when taken out, tested—

Moisture	6·97 per cent.
Sulphur on the wet basis	53·00 ,,
,, dry ,,	57·00 ,,

The percentage taken up in the bulk—that is, on the dry basis—was 13·4 per cent.; while on the wet basis the percentage of increase was 23·2, due of course to the reduction in the amount of moisture.

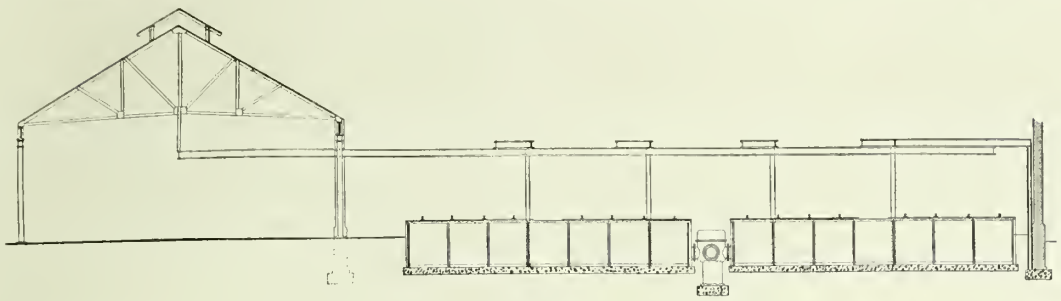
I have at the time of writing had the oxide tested which is at present in No. 1 box; and I append the result of the test—

Moisture	29·06 per cent.
Sulphur on the dry basis	57·00 ,,
,, wet ,,	40·40 ,,

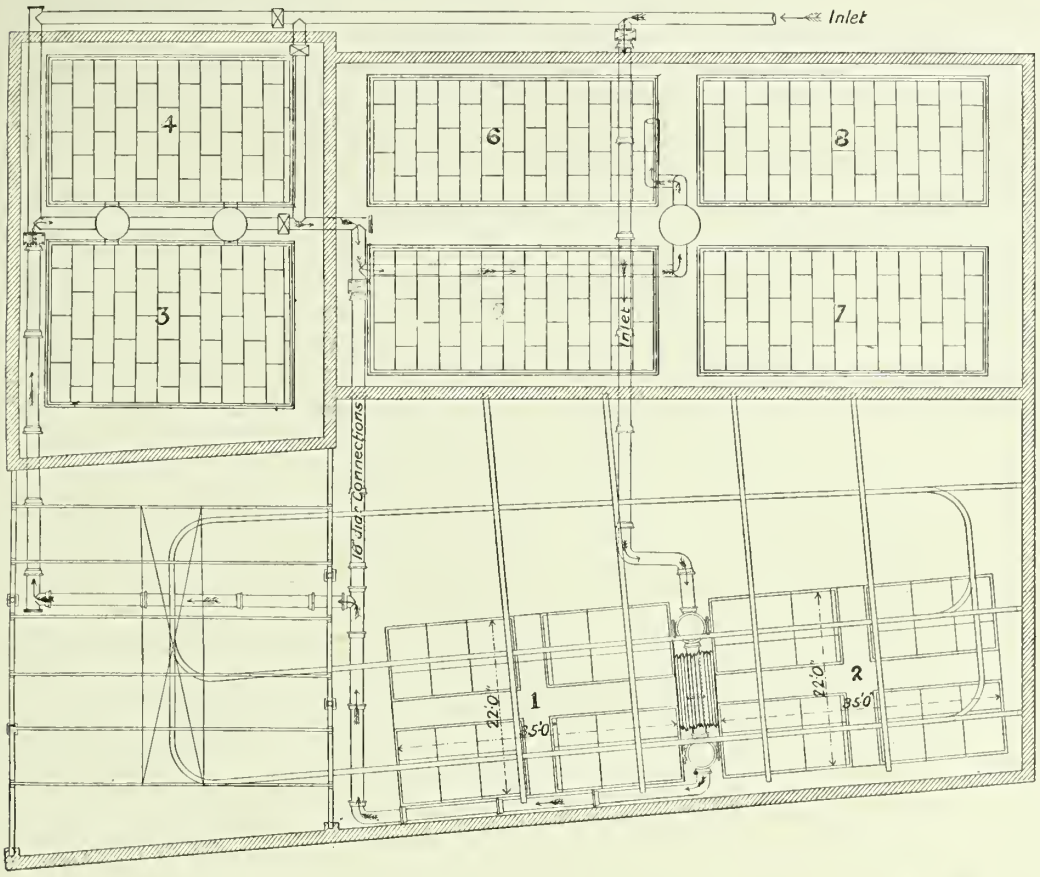
Unless the percentage of moisture be decreased, it will be necessary to work the oxide until it contains 72 per cent. on the dry basis, as the buyers will not take it unless it tests 50 per cent. of sulphur on the wet basis. The difficulty will be overcome by finishing, as previously mentioned, in No. 3 box. Daily tests on all the purifiers are made with the Wanklyn bottle for sulphuretted hydrogen and the states of the purifiers are as below—

	SH_2 per 100 C. Ft.	Gas passed Mills. Pressures.
Inlet of No. 1 Box	520 grains	
Outlet of No. 1 ,,	260 ,,	105
,, No. 2 ,,	50 ,,	96
,, No. 3 ,,	Tinge (= less than 1 gr. per 100 c. ft)	85
,, No. 4 ,,	Very faint tinge	44
,, No. 5 ,,	Clean.	
,, No. 6 ,,	Off.	
,, No. 7 ,,	Clean	109
,, No. 8 ,,	Clean	114

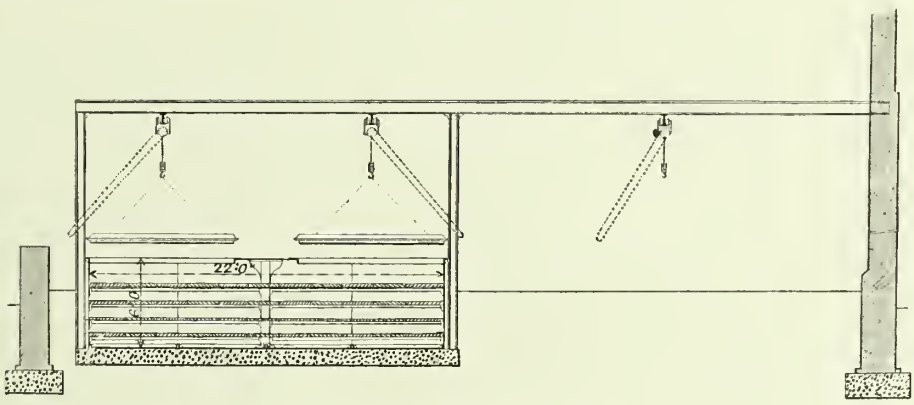
The grids which I use (C. & W. Walker's make) I find act exceedingly well—being simple, inexpensive, and allowing the full depth for oxide being used. The grids are all put in position before commencing to refill, and the box is filled up to the top. About 1 per cent. of air is drawn in at the inlet of the exhauster through a mercurial governor fixed to a 100-light dry meter, the register of which is taken with the station meter, and the gases tested both for lighting and for calorific power. The Carpenter



Sectional Elevation.



Plan.



Cross Section.

Burslem Corporation Purifier Extensions.

standard burner is used for the photometer and a Simmance-Abady calorimeter.

At Pontypridd I had a very rough experience with the 18-inch inlet to the gasholder being blocked with water to the level of the canal. The defect was a bad joint on the tube inside the tank; and as the tank had to be emptied before it could be repaired, a third lift was added to the holder. Fortunately, a 10-inch valve had been fixed, and acted as a byepass. The moral to this is, in erecting gasholders, always to have a byepass.

Burslem is credited with the largest spiral-guided gasholder in the Midlands; and in consequence I am often asked for an opinion. I fully endorse and agree with the retiring President, and can say with him that my anxiety is not with the spiral-guided but with the column-guided holder; and in the event of gales, to which we are very much exposed, the column-guided holders are thrown out of action. The spiral is perfectly rigid and steady, standing out of the ground 120 feet when full, with a capacity of 1½ millions.

While speaking of gasholders, painting as you are aware is a serious item—especially in the vicinity of iron-works, pot-banks, and districts such as ours; and I should be remiss in not bearing testimony to the many labour-saving devices introduced by my predecessor, Mr. Henry Peaty, among which was painting and whitewashing by compressed air. Pipes are laid throughout the works, and the handrailing round the holders is used as air-tubing. The whole of the painting of the gasholders, tanks, purifiers, &c., is done with the machine—not a brush being used. It is both economical aud efficient. The retort and purifyiug houses, workshops, cellars, &c., are also limewashed each year by the same process. The compressor engine is 12 H.P., giving a pressure of 40 lbs. to the square inch at the compressor, and 25 lbs. at the machine.

Whatever may be the future of the coal consumer, there is strong evidence that gaseous firing for domestic and commercial purposes will occupy a very important position in the near future; and it behoves us to work steadily with the view of adopting such means, and exercising such care and attention, as will give results that will practically place coal gas in the forefront for usefulness, economy, and hygiene. I cannot refrain from adding my testimony to the valuable experiments that Mr. Brearley made with gas-fires, as described in his paper before the Institution of Gas Engineers at their June meeting this year. For some time I have

been experimenting upon gas-fires, to make them applicable not only to the drawing-room but to the sitting-room of the artizan. Continuing such experiments, I am satisfied that radiant heat in the simplest form, with a regulated and governed amount of gas, gives the best results. Last year I introduced the hire purchase system of gas-fires—eight quarterly rents covering the net cost of the stove. Gas-fires where purchased are charged at cost price for the stove alone, and fixed free. One point I conclusively settled is that we do not recommend stoves with hot-air chambers, finding as I do that the dust accumulates on the inside, and when lighted gives off fumes, which in rooms used intermittently are very offensive and lead to the condemnation and a restriction in the use of flueless stoves.

Cooking stoves are now so common that it seems superfluous to advise. But there are still hesitations, especially in the colliery districts, to adopt the principle of "easy terms" which is being introduced into every business; and if we wish to keep ahead, we must never allow sentiment to stifle our best endeavours. The subject is always an interesting one; and for success in pushing the gas supply to heating and cooking, I consider it is important to: 1. Advertise and give facilities for demonstrating with a show-room. 2. To be in a position to lay on gas and to fit up houses, cookers, or heaters on "easy terms." 3. To educate consumers in lighting, heating, and all purposes where gas can be used.

Advertising and canvassing are essential; and when we read of and see the enormous outlay by well-known caterers for the comfort and health of the public, we must be convinced that there must be something substantial made out of judicious advertising. Not a season therefore ought to go by without the public being canvassed and advised as to the possibilities of gas, and no opportunities should be lost of seeing them personally. Pamphlets, post-cards, and forms should be freely distributed. The fitters and inspectors should always have in their possession post-cards with the fullest possible particulars on, to distribute wherever opportunity presents. But by far the most practical means of advertising is the show-room; and I cannot better illustrate this than by asking you not to return home without viewing the Shrewsbury Gas Company's show-rooms, under the management of our worthy host, Mr. Belton, which to my mind is undoubtedly the best equipped and most tastefully laid out I have ever seen. It is pleasing and attractive, and every provision is made for showing to the best advantage the various stoves, cookers, appliances, and latest designs in lighting.

The introduction of the slot meter has revolutionized the supply of gas, and has placed it within reach of the humblest. I have strongly advocated for years the slot installation system, whereby applicants (with the consent of the landlord) can have four burners with incandescent fittings and a cooking-stove fixed; the number of feet of gas given per penny being such as to allow 10d. beyond the net price of gas charged to ordinary consumers. The surplus amount is carried to an account created for this particular department.

It may be said that, in colliery districts, cookers are not wanted (and the slot meter system without them is not worth its expense); but this was not my experience at Pontypridd. During the last five years, 2000 stoves were fixed, and the revenue warranted the outlay; for even where the collier gets his coal at cost price, and banks-up his fire for the night, the facility of the cooker is too tempting to resist its use. I have instituted the system in Burslem; and it promises to be the success anticipated.

The education of the consumer in all the phases of gas, has now become a fine art. Many methods are adopted, and we have many wrinkles to learn from our American brethren in this art. It behoves every manager to make such preparations as will give his customers all needful information whether it be as to lighting, cooking, heating, gas-engines, or gas for commercial purposes. Competition, too, behoves us watch that our interests do not go by default; and much business can be obtained, and much retained, where a manager is in a position to educate and, if necessary, demonstrate the true advantages of the latest methods of gas consumption. The rapid strides of incandescent lighting have outwitted our friends the electricians; and our position to-day is stronger in competition than at any other period of its history.

The electric lighting works at Burslem belong to the Corporation; and while the most friendly rivalry exists, the gas and electrical departments are keen with respect to business. I have been called upon recently to show to the best advantage both public and private lighting; my Committee deciding last month to do away with all flat-flame burners in the public lamps and instal incandescent lighting throughout the borough. The lamps used in the centre of the town are high-pressure ones, with three 300 candle-power burners in each lamp on the Keith and Blackman system. But progress in this direction has been stopped by the erection of electric arc lamps, in order to encourage the Electric Committee. Among many installations of high-pressure gas-lighting is that at Messrs. Doulton's works. They have a high-pressure installation in their new works—120 lights from a 400-light meter in conjunction with a belt-driven motor working up to 30 inches pressure. It is so satisfactory that it is being extended to the old works.

Churches and halls have been a speciality with us; and recently the "Staffordshire Sentinel" published the following paragraph which may be of interest:—

WESLEYAN CHURCH, BURSLEM.

For a considerable period, great dissatisfaction has existed among the worshippers of the commodious and handsome edifice regarding the artificial lighting arrangements; and a short time ago, after a prolonged discussion, it was decided to await the introduction of the electric light into the town before finally deciding as to improvements. A strong feeling existed in favour of the newer light; but the advocates of the older system declared in favour of gas. Formerly the church had 93 burners in two "sunlight" clusters. These have now been superseded by two gasaliers, each of sixteen Welsbach burners of 2400 candle power, so suspended that the whole arrangement can be dropped to the floor in a few minutes. Under the gallery are ten patent arc lamps with inverted burners, each giving 180 candle power. These cluster lights are enclosed in large opal globes with steel-bronze fittings. The orchestra is illuminated by Westminster burners, with pneumatic switches. While the total cost of the installation is not one-third of the estimate for the electric light, another important factor claimed by the promoters is that the ventilation has been improved. General praise is heard on all sides as to the satisfactory manner the Fittings Department of the Burslem Corporation Gas-Works has completed the work. The total lighting power inside the building is equal to 4740 candles; and the gross consumption per service will not exceed 600 cubic feet of gas. The general appearance on Sunday evening was most delightful. The sacred edifice was flooded with a soft white light; and the general effect was brilliant. The cluster lights, which are fitted with a separate bye-pass, are under control, and as simple as the electric switch.

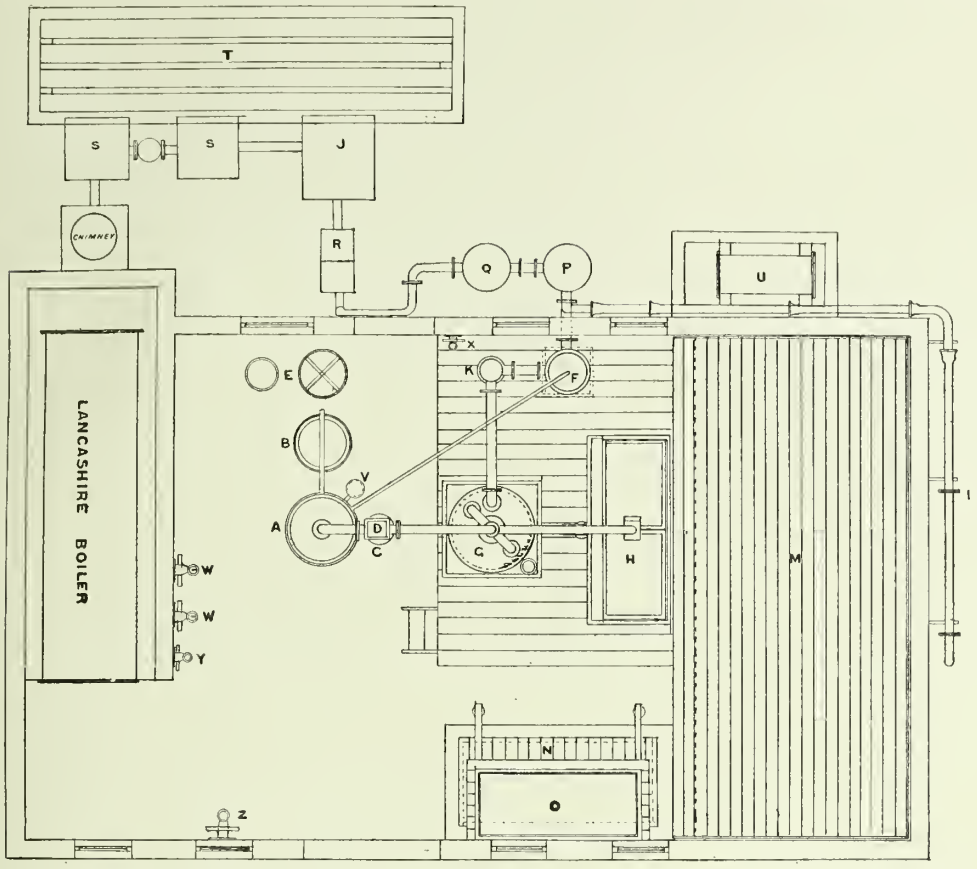
The inverted light has become very popular, and has removed much of the stigma that existed with respect to the want of artistic design which clung to the old chandelier. I have been able to adapt, with great success, the inverted lamp to the work benches and decorators' tables in the china factories in our district; the enamel reflectors and the flexible tubes being especially adapted to this class of work.

There is no question so vital in colliery districts as the disturbance of mains; and much anxiety is caused by subsidences entailing a high percentage of unaccounted-for gas. After severe tests and experiments, I have conclusively proved—at least to my own satisfaction—the advantages of the steel tube as being less liable to breakage, and, with the special joint, less liable to leakage in the event of subsidence. I have just laid over a mile of steel mains; and, in places of extreme danger, I would recommend the long joint as a preventer of accident. Steel mains have many advantages. They are bent *in situ* to the required shape; and, when set up with lead wool, a strong job results, capable of standing a strain of 25 to 30 lbs. to the square inch.

Much has been said of late, and a great deal of useful information has been given by our American friends, on the question of high-pressure distribution. We have not perhaps the opportunities of laying out new districts, but few of us will disagree with the importance of maintaining a pressure consistent with all the requirements of modern needs, whatever that pressure may be. In my opinion, the pressure should at no time of the 24 hours be below 20-10ths in any part of the district. Consumers should have at all times and for all requirements an adequate, and as far as possible a uniform pressure, to enable them to take the fullest advantage of the gas. The fact that high pressure is synonymous with high leakage is not a question that concerns the consumers, but the management; and it does not reflect much credit to allow our mains and services to be laid, or to remain in such a state that will not permit of a pressure equal to the requirements of the district. In the question of leakage, it is not always the mains that cause the trouble, but more often the services; and too much attention cannot be paid to this. A slight initial first cost amply repays. Our services are steam strength; and in made or unsuitable ground they are laid in wood-channel troughing filled in with cement.

As there is much trouble at times with the waste gases and effluent from sulphate plants, I would say a word as to the method adopted by us, and which is highly recommended by the Alkali Inspectors. The plant employed is capable of producing 3 tons of sulphate per diem. In general, it is of the usual design. The arrangement of the apparatus of the plant will be seen from the plan. The closed form of the saturator in operation I have found to be both economical and effective. The man needs only to obtain a proper adjustment of his taps, when no further attention is required beyond the removal of the sulphate from the draining table to the store. The process employed for the treatment of the saturator gases is the combustion-neutralization process. Briefly it is this: The gases leaving the superheater are passed successively through a tubular condenser, an ordinary water cooler, a pipe condenser, and a scrubber. The gases then pass into a coke furnace, where the sulphuretted hydrogen is burned, and the products of combustion pass from the furnace into a brickwork tower of rectangular section, filled with chequer brickwork, and finally through two other brickwork towers which are filled with limestone, and then into the chimney stack. Down the chequer brickwork tower, the effluent liquor from the still is caused to pass; and in passing it absorbs some portion of the sulphur dioxide contained in the gases. Water is pumped to the top of the limestone neutralizing tower, and is evenly distributed over each tower through ordinary rose-sprays. The water passes into the towers through holes in an earthenware top which have a water seal. The water percolates over and between the pieces of limestone, and thus presents a large surface for the absorption of the sulphur dioxide. The gases are made to travel upwards—that is in the opposite direction to the water. The acid gases absorbed are neutralized by chemical reaction with the limestone.

When the plant was installed, it was in the experimental stage; so that some little difficulty was encountered in meeting all the Government regulations with respect to the acidity of the exit

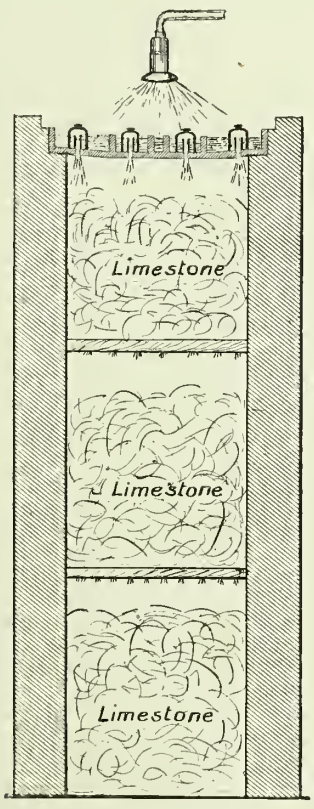


REFERENCES.

A. Large still.
B. Small still.
C. Spent liquor valve.
D. Cast-iron catch-box.
E. Liming arrangement.
F. Heater.
G. Saturator.
H. Draining table.
I. Condenser.
J. Chequer brickwork tower.
K. Lead catch-box.
L. Mother liquor well.
M. Sulphate store.
N. Acid store tank.
O. Acid supply tank.
P. Condenser.
Q. Scrubber.
R. Furnace.
S. Neutralizing towers.
T. Settling tank.
U. Devil-water tank.
V. Pressure box.
W. Liquor pumps.
X. Devil-water pump.
Y. Boiler-feed pump.
Z. Water pump.

Sulphate of Ammonia Plant at the Burslem Corporation Gas-Works.

gases. The maximum amount of sulphurous acid allowed in the exit gases is 4 grains per cubic foot, and sulphuretted hydrogen has to be entirely absent. The condensing portion of the plant was found to be insufficient. The gases being charged with water vapour could not be properly burned; and consequently sulphuretted hydrogen passed into the stack. The water distribution on the towers was also defective. The latter was a simple matter to set right, and the former was overcome by installing



The Neutralizing Tower of the Sulphate Plant at Burslem.

140 feet of 6-inch cast-iron pipes cooled by a water spray. The report of the Inspector of Alkali Works for the year 1906 said:

Since the apparatus has had the advantage of the chemical supervision suggested, better working has resulted. This has been so since the erection of the additional condensers; for those originally put down were found insufficient when the still was worked at full pressure. The gases entering the furnace were, therefore, not dried sufficiently, with the result that sulphuretted hydrogen passed the fire unburnt, and so was found escaping the final tower in the chimney. The alteration referred to consists of 140 feet of 6-inch cast-iron pipes water-cooled, placed between the saturator and the original condensers. By the more complete drying of the saturator gases before reaching the furnace, the difficulty has been overcome. The average total acidity of the gases leaving the furnace, and passing into the towers for the year is 19·3 grains as SO_3 per cubic foot. The average total acidity of the gases leaving the limestone tower and escaping into the chimney is 0·4 grain as SO_3 per cubic foot.

You will observe that we are well within the Government limit. The chief advantage of this method of treatment over that of oxide purification is the reduced labour costs. But where the works are not of sufficient magnitude to afford chemical supervision I would not recommend its adoption, as it does not lend itself to rule-of-thumb working. Since the recent introduction of the use of oxide in heaps, where one heap can be revivified *in situ* while the other is in use, and *vice versâ*, the margin of difference in working costs between the two cannot be so very great; but the neutralizing process would be of service to those who are under restrictions as to effluent liquor. Some authorities will not admit an alkaline or an acid effluent; but by the use of the neutralizing plant, one can acidify the alkaline effluent from the stills with the effluent from the towers, and then render it neutral by passing over limestone.

In bringing my address to a close, I would like to express on behalf of the Association our warmest thanks to the Directors of the Shrewsbury Gas Company, for their kindly welcome to the old historical town which delights both the antiquariau and the lover of Nature, and (what is the utmost importance to us) a well-equipped and up-to-date works, a model show room, and all that accounts for progress and efficiency; and we join heartily in congratulations to our host, Mr. Belton, on the attainment of his 28½ years of unique successful management. The times seem to demand that applicants shall not be eligible when experience is approaching its best; but in view of our present visit and that most interesting event on our visit to Swansea a year ago—when Mr. Thornton Andrews attained his fiftieth year of management—who shall say that the wisdom of the Authorities is sound, "Too old at forty."

Mr. BROWNING, who proposed a hearty vote of thanks to the President, remarked that they could not, on hearing it read, at once grasp all the details in so long an address; but when they saw it in print, they would all be able to add something to their store of experience.

Mr. HUBERT POOLEY (Stafford), who seconded the proposal, remarked that it had afforded him much pleasure to accept the invitation to be present at the meeting—especially as it included a visit to the works of the Shrewsbury Gas Company, which he had not seen previously. He was sure they would all feel very grateful to Mr. Belton for his permission to inspect the works. With regard to the difficulties of preparing an address after so many had been given, he was in a position to sympathize with the President, as he had recently been through a similar experience

But he must certainly congratulate him on the result of his efforts. He had given them ample matter for consideration, and they would peruse the address with very great interest when it appeared in print.

The vote was carried with applause, and acknowledged by the PRESIDENT.

MR. J. H. CANNING'S PAPER ON "NEW ELECTRIC LAMPS."

The next item on the *agenda* was the reading of a paper by Mr. J. H. Canning, entitled "Some Notes on the New Electric Lamps." This will be found on the facing page.

The HON. SECRETARY said Mr. Canning was not present, and he had not heard from him. He thought, therefore, that the best plan would be to leave the paper over till the next meeting, as they had many interesting things to see that day.

Mr. J. C. PENNINGTON (Colwyn Bay) proposed that the paper should be taken as read, and discussed at the next meeting. They could have copies to read meanwhile; and he felt sure the result would be a very interesting discussion.

The PRESIDENT said he thought this would be the best course to pursue, though he would have liked to have heard his friend Mr. Langford give some account of his experience in his dual capacity at Longton.

The motion was seconded, and unanimously carried.

PLACE OF NEXT MEETING.

The PRESIDENT said that, with regard to deciding on the next place of meeting, he was in the awkward position of being without a house in the area of the Association. It would have been a delight to him, had he remained at Pontypridd, to have welcomed the members there; but under the circumstances, he thought it would be best, in the interests of all, to hold the next meeting at Cardiff. It would be at the time of year when many of them were not able to get far away. He therefore proposed that they should meet at Cardiff.

Mr. BROOKMAN seconded; and it was agreed to.

PROPOSED ALTERATION IN THE SEPTEMBER MEETING.

The PRESIDENT said he desired to give notice of motion that the Committee consider the advisability of changing the date of the September meeting. It had been pointed out to him that it was rather inconvenient to meet so soon after the holidays—and, in fact, when many were still away—and he should suggest the alteration of the date from the first week in September to either the last week in that month or the first in October. At any rate, he would give notice of motion that the matter should be considered by the Committee, in accordance with Rule 17.

Mr. PENNINGTON said he would support this. As a matter of fact, he had postponed his holidays so as to be at Shrewsbury that day.

APOLOGIES FOR ABSENCE.

Among those who expressed regret at not being able to attend the meeting were Mr. W. Doig Gibb, of Newcastle, President of the Institution of Gas Engineers, Mr. W. Prince, of Stoke-on-Trent, Mr. J. Davis, of Gravesend, Mr. H. Wilkinson, of Harrogate, Mr. H. W. Woodall, of Bournemouth, Mr. N. H. Humphrys, of Salisbury, and Mr. S. Johnson, the Chairman of the Gas Committee of the Burslem Corporation.

Mr. A. W. ELLIOTT, the Assistant Manager, then read the following short description of

THE SHREWSBURY GAS-WORKS.

The two gas-works in Shrewsbury show quite different lines of retort-house practice. At the old works, the retorts are horizontal, brick built, and are charged and drawn by hand; at the new works, the retorts are inclined, with a full equipment of coal and coke handling machinery.

The New Works.

These works (which are separated from the old works by a large block of buildings) were erected in 1903, on land which had been in the possession of the Company for some years. In their design, the buildings and plant were so arranged that their capacity can be doubled with a minimum of inconvenience and expense. The nominal capacity of the works—as they exist—is 500,000 cubic feet a day, though in practice the retorts produce an additional 100,000 cubic feet a day when required.

The retort-house is 68 feet long by 51 feet wide. Extending along one side of the house, and divided from it by a wall reaching to the roof, is a coal-store 22 feet wide; the retort-house and coal-store being under one roof. In the support of this roof, the front and back buckstays of the retort-bench play an important part. These buckstays, together with the coal-store division-wall, also take the weight of the coal-storage hopper and the conveyor above it. Details of the construction can be seen conveniently from the retort-house interior. As this roof was the first of its kind erected, it may be pointed out that there has been no unequal movement of the structure since its erection. An examination of the exterior shows that the roof presents an even surface from any point at which a sight is taken. By the adoption of this method of construction, the height of the building is less by about 20 feet than is usual in inclined retort-houses. The charging and drawing floors are of reinforced concrete, supported by joists which are carried from the buckstays to the retort-house walls.

Coal is tipped from carts into the breaker-hopper, from which an automatic reciprocating tray-feed delivers it to the breaker. From the breaker, the coal is delivered, by means of a bucket elevator and a push-plate conveyor, into the coal-storage hopper. To supply the coal-store from the breaker, an additional elevator and a conveyor are provided. The coal-plant machinery is all driven by a horizontal steam-engine of 20 B.H.P. The coal-storage hopper extends the length of the bench, and is constructed to receive 60 tons of coal. Sliding doors (moved by levers) regulate the delivery of coal from the hopper to three Denison and Broadhead combined weighing machines and chargers—one charger for each horizontal row of retorts. There are four of Waddell's regenerator settings of eight retorts. The retorts are oval ⌂ in section, 20 in. by 16 in. at the top, widening to 24 in. by 16 in. at the bottom, and measuring 20 feet on the incline. The coke discharges itself on to a Dempster conveyor, by which it is conveyed up an incline, and delivered into a rotary screen. This screen sorts the coke into four sizes; each size being delivered into a separate hopper. A conveyor of the same description as the hot-coke conveyor receives surplus coke from the screen, and delivers it to the coke yard.

The ascension, arch, and dip pipes are 8-inch. The hydraulic mains are of semi ⊃ section, and are fixed in front of the ascension-pipes; thus they are quite clear of the settings. They are supported on steel joists extending from the front buckstays to the retort-house wall. Each hydraulic main is provided with a 4-inch flush-out pipe; two smaller pipes supplying the main with ammoniacal liquor. Bolted to the flat side of the main are two cast-iron boxes having removable lids. These boxes are so fixed that they give access to the interior of the main through liquor-sealed openings, and so permit any solid deposit to be removed without interfering with the regular working of the retorts. The foul main is 18-inch, constructed of steel plate, and carried along the retort-house wall, gable end, and side wall of the coal-store to the condensers.

The condensers are four in number, annular, 36 feet high by 4 ft. 6 in. outside diameter, and are constructed of steel plate. Near the condensers are the pump-house and boiler-house. Supported by the pump-house walls is a cast-iron tank, which is divided into three compartments for water, liquor, and tar. The boiler-house contains two Cornish boilers, each 24 feet long by 6 feet diameter. Both boilers are fitted with Meldrum furnaces. There are two exhausters of the rotary type, each of 25,000 cubic feet per hour capacity. Following the exhausters are a Livesey washer, two tower scrubbers (35 feet high by 10 feet diameter), a Pelouze and Audouin condenser, and a naphthalene washer. The Pelouze and Audouin condenser and the naphthalene washer were erected in the spring of this year, and have already done excellent service. The naphthalene washer is charged with the Leicester solvent.

The purifiers are raised 15 feet above ground level, and are carried on girders supported by I-steel uprights. The outer rows of uprights are 32 feet high, and at the top carry lattice girders, which support the roof. The purifiers are of the Green type, in one block, which is divided by cast-iron plates to make six boxes, each 20 ft. by 15 ft. They are worked by Weck valves, and are arranged in two sets—a set of four followed by a set of two. All are charged with lime. The lime is prepared on the ground level, and loaded into tip-waggons. Rails to take the waggons are provided on the ground level, and on the middle row of top plates of the purifiers. A hydraulic hoist conveys the waggons to and from the top rails. The spent lime is discharged through shoots either into tip-waggons or into carts. The station meter is rated to pass 25,000 cubic feet per hour. A small Cowan governor, in the meter-house controls the pressure of the gas supply to the works. Near the works entrance are the men's mess-room, with bath-room, weigh office, foremen's room, and small general store.

The gasholder at these works is 150 feet in diameter, and of 750,000 cubic feet capacity. This gasholder and the sulphate works were the only structures on the site up to the time of the erection of the new works. At the sulphate works the ammoniacal liquor is dealt with by concentration; a crude spirit containing about 15 per cent. of ammonia being obtained. The working up of the liquor has been attended with some trouble, owing to the difficulty of getting rid of the effluent. The present practice is to dispose of it by evaporation—as much as possible under the retort-furnaces, and the remainder by means of specially constructed evaporators.

The Old Works.

The old works stand on ground which includes the site of the original works, which were erected after the Company was founded in 1820. As they exist, they are equal to a production of a million cubic feet per day. Owing, however, to the much lower working costs at the new works, the old works are only brought into use during the winter months—that is, when the demand exceeds the capacity of the new works.

The retort-house contains fourteen generator settings, each of six through, 22 in. by 15 in., ⌂ retorts, 20 feet long. The ascension, arch, and dip pipes are 6 inch. The hydraulic main is square in section, and constructed of steel plate. The foul main is also of steel plate, and is 18 inches diameter. It is carried along the two sides and the gable end of the retort-house to the condensers. Valves in suitable positions are provided to vary the length of

travel according to requirements. The condensers are of cast iron, and annular in section. Near the condensers are the boiler-house and the exhauster-house. The latter contains two Gwynne exhausters, each of 60,000 cubic feet per hour capacity. The gas, after leaving the exhauster, passes through two tower scrubbers —the first scrubber having a Livesey washer at the base. A naphthalene plant, similar to that which is so successful at the new works, is in course of construction, and will deal with the gas before it reaches the purifiers.

There are two purifier-houses; the larger having four boxes, each 24 ft. by 20 ft. No. 2 House originally contained four water-lute boxes, each 20 ft. by 12 ft.; but these, being of too small area, were converted to two boxes of the Green type, each 29 ft. by 20 ft. The governor and meter-room and the men's mess-room are in a two-storeyed building; the upper storey being used as a general store. There are two holders at the works, of 180,000 and 130,000 cubic feet capacity respectively. Before the gas leaves the works for the district, it is passed through a Cripps carburettor, and treated with benzol, if desired.

The old works also contain repair shops and stores for meters and stoves. At other parts of the yard are blacksmith's and works fitter's shops, also a coal-testing plant dealing with one-tenth of a ton at a time, which is of great value.

Mr. Belton said he would like to supplement the remarks of Mr. Elliott by telling them that when the old works were built in 1820, Mr. Grafton was employed as Engineer. He had just previously completed the works at Derby and Wolverhampton. Some time afterwards in the original minute-book of the Company there was recorded the fact that Mr. Grafton was dismissed from his position as Engineer of the Shrewsbury works because he had ordered too many pipes, tees, and bends, and after the main-laying had been completed there were some left over. In 1824, there was another very curious entry in the minute-book. It seemed that a gasholder-tank which was now converted into a liquor well had just been completed, and the pipes were laid in the bottom, but the stand-pipes were not put in. Mr. Green conceived the idea of filling a balloon in the tank, and was permitted to do so. It held about 16,000 cubic feet of gas; and when it had been filled in the tank, it was carried to a field a short distance away from the works, and there exhibited for three or four hours. Mr. Green then made an ascent (in which he attained an elevation of about 2½ miles), and landed somewhere in Radnorshire—about 34 miles from Shrewsbury. This he believed was one of the first instances of coal gas being used for the filling of balloons. He happened to come across these entries in the original minute-book of the Company a few days ago, and thought they might be of interest. His Directors hoped that, after the inspection of the works, all those present would partake of tea in the town.

Thanks to the Shrewsbury Gas Company.

The President proposed a hearty vote of thanks to the Chairman and Directors of the Shrewsbury Gas Company, and to Mr. Belton, for the use of the offices for the holding of their meeting, and for the hospitable way in which they had been received. It was almost proverbial in Shropshire what the Gas Company had done. Mr. Belton's name was as well known as, or better even than, that of their own Member of Parliament. It was a long time since he first made the acquaintance of Mr. Belton; and he remembered the good advice he gave him then—some sixteen or seventeen years ago. He had always regarded him as being one of the best members of the profession. He had steadily gone on; and not only Shrewsbury, but a great deal of the county, owed very much to him.

Mr. Pennington, in seconding, said Shrewsbury appealed to him as an old town, and he was pleased to be present.

The vote having been heartily agreed to,

Mr. Belton returned thanks on behalf of the Directors, and again expressed their regret that absence from home and other unavoidable circumstances had prevented any of them being present. None the less they welcomed the Association, and were glad that the members should come to see their works, of which they naturally felt a little proud themselves. On his own behalf, also, he returned thanks for the flattering references that had been made to him. Of course, one could not live for some thirty years in a district without being pretty well known. He trusted that during his career at Shrewsbury he had made a good many friends; and he did not think he had made any enemies. At all events, he had always tried his best to do what should be done, and had devoted all his energies and such abilities as God had blessed him with to the service of the Company. If he had met with a fair measure of success and appreciation from the Company and the public, he was perfectly satisfied.

Authors of Papers Thanked.

The Hon. Secretary moved a hearty vote of thanks to Mr. Elliott for his paper and for all the trouble he had taken; and also to Mr. Canning for his contribution.

Mr. Browning seconded.

The President said he hoped for a very good discussion on Mr. Canning's paper at the next meeting.

The vote was heartily accorded; and Mr. Elliott replied.

The members then proceeded to inspect the gas-works, at the conclusion of which brakes which were in attendance conveyed them to the Shrewsbury Café, where the excellent meat tea which was provided for them was thoroughly enjoyed.

SOME NOTES ON NEW ELECTRIC LAMPS.

By J. H. Canning, of Newport (Mon.).

[A Paper prepared for the Wales and Monmouthshire District Institution of Gas Engineers.]

In the following brief and rapid survey, much that is already well known must unavoidably be included. Still, as it is essential, in competition of every kind, not only to be well acquainted with one's own position, but to have a general knowledge of one's opponent's, it has occurred to the writer that a few remarks on the latest developments in electric lighting may be of use.

In the earlier days of electricity, many attempts were made to produce a satisfactory incandescent lamp with a metallic filament. Platinum and some others of the more refractory metals were made use of to this end. But, for various reasons, none of these lamps were commercially successful; and incandescent electric lighting first entered into general competition with gas upon the invention of the carbon filament lamp with Edison thirty years ago. At that time, and for many years after, the flat-flame gas-burner was the one in ordinary use. But after the invention of the incandescent gas-light by Welsbach, electricians strove to press the rare earths into their service; and the outcome of their endeavours has been the well-known Nernst lamp. For reasons, however, to be detailed later, the earths which were so easily adaptable to the purposes of gas lighting proved somewhat intractable when electricity was used as the heating agent; and invention harked-back, as it almost always does, to the earlier idea—viz., the metallic filament lamp.

The steady advance of chemical science in the interim made available for the electrician's purpose a number of refractory metals almost unknown to a previous generation; and the result is before us to-day in the numerous "metallic" and "metallized carbon" filament lamps for which such remarkable results are claimed and promised. At the same time, the first known form of electric illumination—the arc lamp—was not overlooked; and attempts, more or less successful, have been made to improve its efficiency, which have resulted in the so-called "flame" and the "mercury vapour" arc lamps. These various types of lamp will now be dealt with more in detail.

The Mercury Vapour Arc Lamp.—This consists of a vacuum tube containing mercury and its vapour, through which an arc is started by the tilting of the tube; thus establishing momentary contact. The lamp will work only on continuous current at low voltage; and though an efficiency of 0·4 watt per candle power is claimed for it, the lamp has not been adopted to any extent, owing to the weird, unearthly character of the light omitted by it, in which the red rays are entirely absent. It is proposed to remedy this defect (by adding sodium and other metals to the mercury, or by the device of running a glow lamp in conjunction with the arc), but, up to the present without much success, as the efficiency is thereby considerably reduced.

The "Flame" Arc.—This lamp has been far more in evidence as a competitor with gas lighting than the one previously alluded to. It owes its unique and peculiarly coloured glare to the fact that the carbons employed are impregnated with various volatile salts in order to increase their efficiency. A longer arc is consequently produced; and the carbons are so inclined to each other (similarly to the legs of the letter V) that the arc lies in the horizontal plane—its position being further controlled by means of a magnetic field. The makers of these lamps claim for them an efficiency of about 0·13 watt per candle power; but as estimates of the candle power vary as much as 100 per cent. from each other, extremely little information is available upon the point. While it may be observed that, according to information presented to the Birmingham Section of the Institution of Electrical Engineers, a 9-ampere flame arc costs as nearly as possible, for current at 1½d. per unit, carbons, and trimming, £20 per year of 3700 burning hours, still the question of cost has been so often and so ably dealt with elsewhere that it is not proposed to go into it more fully in this paper.

Though the actual intensity of the light is very great, this lamp possesses in an accentuated degree the great defect of all its predecessors—viz., the concentration of practically the whole of its light upon a very limited space immediately beneath it. It is quite unnecessary to labour this point, or to draw attention to the fact that, for street lighting in particular, this is not only not the best method of illumination, but may become a source of positive danger.

But the flame arc has opened out for itself a new field and a fresh title to fame in its application, under a complete misapprehension, to advertising purposes. Tradesmen in the past employed lamps chiefly for the purpose of exhibiting their wares to the best advantage, and they used and paid for the quantity of light necessary for the purpose. A mistaken notion—rather the effect of suggestion than of intuition—has, however, become prevalent among them, that to secure custom it is necessary to exhibit on a shop-front the most glaring lamp to be obtained. It is perfectly evident that, however suited such methods of attraction might prove to a community of Hottentots or Tonga Islanders, it is rating the intelligence of the average educated Briton at a very low level to dangle before him these blinding

Spectrum of a Flame-Arc Lamp.

and flickering lights, which, according to one of the leading electrical journals, attract none but "moths and loafers."

It is essential to point out strongly to all present or prospective consumers that, as obtains in the case of every other commodity, there is a certain quantity of light necessary in every instance, and to pay for more is sheer waste. The electrician is unable to subdivide his immense units of light, and he foists them wholesale upon the consumer, who is led to fondly imagine that the enormous waste of energy will in some occult manner bring him a golden harvest. While the writer is fully aware that these lamps are sometimes hired to consumers by electrical undertakings at unremunerative and inclusive rates, yet it may be pointed out that such lights are confined to the outside of business premises of which the proprietor in nearly every case finds it more advantageous to light the interior by means of the incandescent gas-light.

The mechanical and other defects of the lamp are numerous; the most important being: (1) The poisonous fumes produced, which make the use of the lamp dangerous in a room and ruin the mechanism. (2) The volatilized salts also condense upon the globe—obscuring it, and endangering the electrical insulation. (3) The carbons are costly, and leave a large amount of ash. (4) The unpleasant hue of the light emitted.

With reference to the last of the above defects, it occurred to the writer that, the light of the flame arc being derived from incandescent vapour, the spectrum of this light would prove to be in great measure a non-continuous one; and careful examination with a spectroscope has confirmed this supposition, the spectrum being approximately as shown on the diagram. The spectrum of the sun and of practically all artificial illuminants is continuous, embracing light of every wave length within certain wide limits; and the ideal of all who have studied this subject seriously has been to produce a light approximating as nearly as possible to that of the sun in quality.

Here, however, we have a distinctly retrograde step. The flame arc spectrum is not continuous in any sense of the word; consisting almost entirely of the line spectrum of calcium, with traces of potassium and other metals. Large gaps exist in all portions of the spectrum; the consequence being that such a light imposes upon everyone complete colour blindness, *nolens volens*, not in respect of one colour only, but of nearly all shades of colour. The streets of our towns are hardly so beautiful at the present day that we can afford to see them robbed of the small attractiveness they possess. What an eminent scientist calls "a fortuitous concourse" of odd rays taken at random from distant points in the spectrum, can no more be termed illumination, than can the sound produced by a piano with nine-tenths of its keys missing be called music.

Another aspect, and a more serious one, presents itself. That long-suffering but most wonderful and delicate of organisms the eye, cannot long withstand the strain to which it is subjected by the light emitted by these and similar lamps. There may be upon other planets eyes so constructed as to view objects in a light such as this without inconvenience. The human eye, however, is not so fashioned; and the attempt to accustom it to such unnatural methods of illumination must result in strain and eventual disaster.

Let any unprejudiced person view in turn the goods in shop windows illuminated respectively by means of the flame arc and the incandescent gas-light, and he will be compelled to admit that the latter not only exhibits the goods to better advantage, but enables a prospective customer to examine them at his ease without being driven away blinking and half-blinded, as so many are, by the glare of the former. Tradesmen are rapidly adopting this view of the case; many of them having discovered, to their cost, that the flame arc, throwing its splashes of tawny light over a shop front, really possesses a repulsive rather than an attractive effect.

The Nernst Lamp.—In this type of lamp, a small rod made of metallic oxides, similar to those so successfully employed in the incandescent gas-mantle, is heated by an electric current. The rare earths, however, are non-conductors of electricity when cold; so that a heating device must be attached to each lamp in order to raise the temperature of the glower to the point at which it becomes a conductor. This work being achieved, the heater is automatically cut out. Another difficulty presents itself in the fact that the resistance of the rod, when thus reduced, does not remain constant, but progressively decreases—necessitating a second device termed a "ballasting resistance," which usually consists of an iron wire sealed into a tube containing hydrogen.

When first put upon the market, an efficiency of 1·2 watts per candle power was claimed for this lamp. Practical use, however, has demonstrated the fact that 2 watts or even more per candle power is a more accurate estimate of the quantity of current consumed; while the apparent economy over the carbon filament lamp must be largely discounted, owing to the glower, which is expensive, having a life not exceeding 200 hours, and frequently falling as low as 50 hours.

It might reasonably be expected that in the Nernst lamp—combining in itself, as it does, an electric lamp, an electric heater, an automatic cut-out, and a resistance, each with its numerous defects—the probability of failure of the whole would, following the well-known law, amount to the sum of the probabilities of failure of the separate portions. Experience has amply demonstrated that this is the case, as all the component parts of the lamp require frequent renewal at some considerable expense; and the makers have recently fitted more than 20,000 lamps with the new cut-out coils free of cost—the older types having proved to be most unsatisfactory.

Metallic Filament Lamps.—Carbon does not yield so good a return in light rays for the heat energy expended upon it as metallic bodies do; but great difficulty has been experienced hitherto in the successful application of metallic filaments to electric lighting, due to their comparatively low fusing-points and resistances. Nearly all the metallic elements known to modern chemistry have been examined with a view to ascertaining if they possess the necessary physical properties; and though no metal even remotely approaching the electrician's ideal has been found, such out-of-the-way elements as iridium, osmium, tantalum, tungsten, zirconium, and molybdenum possess, in varying degrees, some of the necessary attributes.

With more or less success, certain of these metals, notably tantalum, osmium, and tungsten, have been formed into threads comparable only with those of the spider in their extreme tenuity. Still, in order to obtain the necessary resistance, about 25 inches of such filament are required for each lamp; and, as may well be imagined, the most minute care and the greatest manual skill are necessary in winding the fine metallic thread upon its supports. Some idea of the slender nature of these filaments may be obtained from the fact that 1 lb. of tantalum furnishes 20,000 lamps, each of which, therefore, contains only about $\frac{1}{3}$ grain of the metal.

The best known and the most generally used of these lamps are the "Osmium," the "Tantalum," and the "Osram." These are typical examples of a class whose number already threatens to become legion. Of the three whose titles are given, the first two bear the names of the metals respectively employed in their manufacture; while the filament of the third consists of an alloy of osmium and tungsten.

The most remarkable efficiency—even 1 watt per candle power—has been claimed for these lamps by the makers; while electricians who use them do not claim an efficiency higher than from 1·3 to 1·6 watts per candle power. Recent tests by independent authorities seem, however, to indicate, a duty little, if any, better than that of the Nernst lamp. On the other hand, whatever may be the advantage realized in the consumption of current, these lamps possess inherent defects which militate immensely against their general adoption. The filaments are so fragile that one authority doubts if any but a limited number will survive the perils of transport, fixing, and dusting, and thereafter complete their allotted span, which appears not to exceed 600 hours on an average. The lamps possess a decided objection to alternating current or to any voltage above 130, having to be run in series on all modern high-pressure supplies. In order that even this may be possible, they require to be most carefully paired, or certain disaster will result.

In consequence of the semi-fused or plastic state of the hot filament, very few of these lamps may be fixed in any but the vertical position, when, owing to the method in which the filament is wound, little or no direct light is thrown vertically downwards; and a reflecting top has been found necessary so as to overcome this defect. In addition, variations in the pressure of supply affect the lamps most injuriously, due probably to the fact that the heating effect of the current varies directly as the square of the number of amperes, or, resistance being assumed constant, as the square of the voltage. Consequently small upward variations in pressure tend to produce fusion or volatilization of the filament. In fact, the blackened condition of many of the bulbs of these lamps seems to indicate that the latter action is constantly taking place under normal conditions. The alternate expansion and contraction of the filament when the lamp is switched on and off is also a fertile source of failure.

The history of the electrical industry for many years has been that of a series of compromises with the inexorable laws of physics and of economics. Nor do the metallic filament lamps present an exception to this rule. Owing to the high price of copper during the last few years, almost every electrical undertaking in the kingdom has doubled the voltage of its supply; and hardly has this been accomplished when, by the irony of fate, a more economical lamp, suitable only for low voltage systems, however, is produced. Those undertakings which retained low-pressure supply with its high cost of distribution, appear to be little, if any, better off; as great fear is expressed by electrical engineers that the load factors of these concerns, built up with such care, will be ruined by the employment of the more economical lamps.

Much has been said lately to the effect that these more efficient methods of lighting would at length bring electricity within reach of the working man, who is represented as possessing a most insatiable craving for the introduction of this agent into his dwelling for lighting purposes. The metallic filament lamps cost at least 4s. each, and it may be at any rate surmised that the working men of this country are not prepared to spend for each renewal of their electric lamps a sum for less than which two complete incandescent gas-burners, with chimneys and mantles, may be had; while, on the other hand, if electrical undertakings free-wire the houses, making an inclusive charge for energy to cover interest, renewals, &c., it is very probable that the improved efficiency claimed for the new lamps will become a dead-letter owing to the prohibitive charge for current. However, even under the most favourable circumstances—allowing the very high efficiency of 1·3 watts per candle power, current at 3½d. per unit (which is less than the average charged over the whole kingdom) and a life of 600 hours—the following comparison of the cost of two 32-candle power osram lamps and of an incandescent gas-light of equal power over a year of 1800 hours will show that there is no ground for supposing that our industry will fail for a moment in maintaining its premier position.

Electricity.

	£	s.	d.
Two osram 32-candle power lamps, at 1·3 watts per candle power for 1800 hours—energy consumed (say) 149 units, at 3½d.	2	3	5½
Renewals, six lamps, at 4s. each	1	4	0
Total	£3	7	5½

Gas.

	£	s.	d.
One 64-candle power incandescent gas-burner, consuming (say) 4 cubic feet per hour for 1800 hours = 7200 cubic feet at 3s.	1	1	7½
Renewals, three mantles, at 4½d. each	0	1	1½
Total	£1	2	9

An examination of the comparison will show that, though a generous allowance of gas and mantles has been provided, yet, for equal amounts of light, incandescent gas is only one-third the cost of the most efficient of the metallic filament lamps. Another and a very important point is that, while renewals form upwards of one-third of the total cost of running the electric lamp, in the case of the gas-lamp they amount only to a twentieth of the total. A life of 600 hours has been allowed these lamps for the purposes of the preceding comparison. But the writer has ascertained that the actual average life of a tantalum lamp in a shop window where it is exposed to the vibration of traffic is only 216 hours; while of two osram lamps fixed in series in a similar position, one failed after less than five hours' burning—consequently throwing both lights out of action.

While the writer yields to no one in his admiration of the high scientific knowledge and technical skill expended upon the production of these lamps, still the consumer (who is supreme in these matters) pays scant attention to even a miracle of ingenuity unless its beneficial influence is distinctly evident upon the credit side of his balance-sheet. The rivalry between gas and electricity will not be settled upon the photometer-bar, or even by the portable photometer, whose reputation for veracity is second only to that of the expert witness. But the battle must be fought and decided in the public streets and in the houses of the people, who, after all, are the best and the only judges of that which so intimately concerns them. The gas industry may, with every confidence, leave the issue in their hands; for, upon the score of efficiency and of economy, the incandescent gas-light is up to the present unrivalled, and bids fair in future to be unassailable.

The Gas Department of the Nottingham Corporation has lost one of the oldest employees connected with the undertaking in the person of Mr. John Reeve, who died on the 2nd inst., in his 70th year. He entered the service of the Nottingham Gas Company when he was a lad, and quickly advanced to a position of trust; and his business capacity was recognized by the Corporation soon after the gas-works were acquired in 1874, when he was appointed Superintendent of the Distribution Department. This post he held with conspicuous success. Altogether his services extended over the long period of 58 years. He was universally respected, and his relations with the men were of a most cordial nature.

INVERTED LIGHTING WITH IGNITION FROM A DISTANCE.

A recent issue of the "Journal für Gasbeleuchtung" contained the text of a paper on the lighting from a distance of gas-burners for public and private purposes, read by Herr G. Kern, of Strassburg, before the last meeting of the German Association of Gas and Water Engineers.

Private Lighting.

The author began his communication by expressing the opinion that in a house pilot-flames were often dangerous and sometimes not wholly devoid of odour. Hence the system of lighting from a distance most suitable for application to the burners of a private residence was one in which, without the aid of such pilots, the gas was ignited and afterwards extinguished from any desired spot. Unfortunately the only plant at present available that answered this requirement was the invention of Herr Mohrstein, and was known as the "Multiplex." Its essential feature consisted in producing a spark by means of a battery yielding a current of between 4½ and 9 volts, and an induction coil, the make-and-break of the current being obtained by mechanical agency. As the production of a 1 mm. spark in air which could be trusted always to ignite a stream of gas required a voltage of about 5000, the primary current had to be raised to a voltage of as many times 5000 as there were burners in series to be lighted by the same battery. The induction coil of the Multiplex comprised a spring, set in motion by hand, which interrupted the current periodically in the usual fashion for a considerable period of time. In places where æsthetic considerations did not have to be studied, the gas-cocks of the Multiplex were opened and closed by hand, and were generally placed quite close under the burners, arranged after the manner of a chain cock. In other places, a special electromagnetic cock-opener was employed which could be operated from any distance and would control inverted burners as well as upturned burners. These electric cocks were usually fixed within the ornamentation of the pendant or bracket, so as to be invisible. They were made in various sizes according as they had to pass gas for one or more individual burners. Herr Kern remarked that the cock should be placed as near to the burners as possible, and that the tube between them should be as narrow in diameter as could be arranged, so that the air might be expelled without delay, and a long succession of sparks not be required before the gas was iguited. He also considered that, as in the case of other distance lighting appliances, it would be advantageous if the makers of the Multiplex were to supply the trade with their lighting devices as integral parts of pendants and the like, in order that the erector should only have to connect them up with the battery and the switch. In this way, the complete fitting would be more elegant in appearance than when the lighters were simply screwed on to some part of a bracket or pendant designed for other purposes.

At the time of reading his paper, Herr Kern stated that 262 Multiplex installations were out on loan in Strassburg among gas consumers; 150 of them being in hotels, 72 in business houses, and 40 in private residences. The burners in each installation ranged from 3 to 136 in number; the gross total being 2418, more than half of which were inverted. Including the expense of teaching the men how to assemble the apparatus, these installations had cost the gas undertaking about 18 marks per burner; but the further experience that had since been gained allowed a single upturned burner provided with a hand-worked cock to be erected for about 8 marks, exclusive of the battery. The present cost of erecting a single inverted burner fitted with the electromagnetic cock mentioned above came to about 17·80 marks; and the author stated that it would pay the gas-works to let the Multiplex lighters out on loan among their customers at the rate of 1 mark per burner per month. The cost per single burner of fitting up grouped lights controlled by a single Multiplex was less, and might be as little as 8·90 marks inclusive of battery. The staff employed erecting Multiplex lighters in Strassburg comprised an inspector, foreman, and ten fitters and labourers; and it was worth noticing that the system had enabled the proprietors of the gas-works to win back some old consumers who had adopted electricity on account of the advantage of the switch.

Herr Kern said there was some difficulty in quoting the average cost of maintenance. For example, in his show-room at Kehl, he had an installation comprising a six-light pendant and four brackets which was working perfectly and did not require any particular attention; whereas in his own house he had one ten-light, one six-light, and three three-light pendants, besides a number of single burners, connected with the Multiplex lighter, which required examining at least once a month. It was very necessary to remember that the chief requisite in maintaining any distance lighter in good condition was that the ordinary gas fittings and pipes, &c., should be perfect. Therefore, in the case of a private residence, special care should be taken by the men erecting a Multiplex that the whole of the existing plant was satisfactory, lest any stoppage in the service, or breakage of the chimneys round the mantles, should be reported by the consumer as a breakdown or as the fault of the automatic lighting arrangement. On the assumption that the whole of the ordinary gas-fittings were in perfect condition, there were four chief matters to look after in keeping

an installation of Multiplex lighters in satisfactory order. It was necessary to see that: (1) the battery was strong enough; (2) the induction coil was in order, and that the electric cock was tight; (3) the electrodes were clean and in correct positions; (4) too long a succession of sparks was not required to light the gas or, in other words, that the cock was not so far from the burner that the gas took an appreciable time to reach it. In this event, the only remedy was to bring the cock nearer the burner. Naturally, however, it must not be exposed too greatly to the heat, and in a downright inverted burner it should be kept at some distance from the light. If there were no short-circuit about the battery, and yet in ordinary circumstances it did not last for a year, the number of cells should be increased.

Herr Kern concluded his remarks on the subject of the Multiplex by pointing out, first, that the appliance was different from other distance lighters, inasmuch as one cock would, if required, control several lights; and, secondly, that since it was expensive and complicated to fit up, it could only be introduced in towns where the gas undertaking had an outdoor department.

Public Lighting.

In the second part of his paper, Herr Kern proceeded to discuss the various automatic arrangements that had been devised for lighting the public lamps of a town, dividing them into three classes, according as they were actuated by clockwork alone, by clockwork temporarily released by a wave of pressure, or by successive pressure waves alone. Nearly all the appliances, he said, hitherto invented required a pilot-flame consuming some ¼ cubic foot per hour at each burner. This was a very serious defect, not only because of the danger that the pilot might be extinguished by wind, but also because the consumption was too large to be ignored. The lighting arrangements that had been tested for the longest period of time were those of the first class, and depended for their action upon clockwork only. The oldest was probably that devised by Rothenbach about ten years ago, which had been taken up by the Aktiengesellschaft für automatische Zünd und Löschapparate, of Zurich. It had recently been modified, and was now known as the "Zula."

It consisted of an accurate sixteen-day clock movement enclosed in an aluminium box, dust and water tight. At one side there was a face on which the time could be read in the ordinary way. Part of the casing could be removed to render the mechanism accessible, so that the times of lighting and extinguishing could be set by hand; but the appliance was also fitted with a special disc that altered these times automatically according to the season. The ordinary lantern cock was replaced by a metal valve normally resting on its seat, and so closing the gas passage. During the time when the burner was alight, however, the clock movement held the valve above its seat and allowed the gas to pass. The ignition of the gas was performed electrically with the aid of an influence machine driven by the clock; several sparks being successively passed between the terminals, for fear the first might fail to ignite the gas. At the moment when the mechanism began slowly to open the main gas-way, a jet of gas was liberated inside a protective casing, and, inflamed by the spark, yielded a non-luminous flame, which promptly lighted the gas of the burner proper. The whole appliance cost about 60 marks.

Another public distance gas-lighter, of which 6000 specimens were now in use, was made by the "Deutsche Gaszünderfabrik Elberfeld." In this apparatus one face was provided for reading the time, while the other was fitted with a pair of special hands. As soon as the first hand reached its highest point, a lever moved, and the plug of the gas-cock was turned round until it was fully open. When the second hand arrived at its highest point, the operation was repeated, and the gas-cock was closed. The clock had two springs, and required to be wound up every fortnight. The apparatus cost about 37 marks.

In passing, Herr Kern mentioned that the Gunning and the Horstmann* apparatus, which, like the Zula, automatically adjusted the times of lighting to the seasons, were largely adopted in England, and that several devices of similar character were being tried in France.

The author next described the distance lighters introduced by Kilchmann, of Wohlen, one of which belonged to the first class and the other to the second, being partly actuated by clockwork, and partly by a wave of pressure coming through the main. The clockwork itself in the latter was very much like that in the lighter which required no pressure wave; and both were enclosed in double cases to protect them against rapid changes in temperature and to prevent evaporation of the lubricating oil. The gas valve was placed within the lantern—that is to say, close to the burner, and was opened and closed by a lever moved by the train of clockwork. The leather membrane which transmitted the wave of pressure was placed underneath the clockwork, and was used to liberate the latter. The pressure wave lasted two or three minutes, opened the gas-valve slowly, so as not to expose the mantle and chimney to a sudden change in temperature, and finally extinguished the pilot-flame through the agency of a valve connected with the valve on the main supply pipe. The clockwork consisted of only four wheels driven by means of a strong spiral spring; and since it remained stationary, except during the few minutes when the flame was being lighted and put out, it only required winding up about every six months. The pilot-flame was fixed close to the burner, and surrounded with a jacket to protect it from the wind. The Kilchmann pressure lighter could be so arranged that a second wave extinguished certain lamps only, while a third wave extinguished the remainder. The apparatus for use in conjunction with a wave of pressure cost 32 marks; whereas that in which the whole cycle of operations was effected by the clockwork cost 38 marks.

The third class of appliances were those actuated merely by a wave of pressure, the chief example of which was the "Bamag."* In referring to this distance lighter, the author mentioned that experiments had been carried out with Bamag pressure-recording gauges placed on the gas-main at distances up to 3½ miles from the gas-works which showed that the pressure wave of 31-10ths —*i.e.*, of 8-10ths above the highest night pressure—was communicated with absolute sharpness to the extremities of the distributing system, and that its passage through the mains did not produce the least prejudicial effect upon either the public lamps or the sensitive inverted burners alight on the gas-works or in different parts of the district. The Bamag was undoubtedly an excellent apparatus; but in the author's opinion it did not lead to any economy in the consumption of gas. Indeed, in a place like Strassburg, if the loss of gas caused through hand lighting were represented by the figure 100, the loss through hand extinction at midnight or in the morning would be altogether 200, whereas the unavoidable waste due to the permanent pilots would reach 900. The economy attainable by the employment of a distance lighter must be rather sought in the wages of the man attending to the burners. According to figures derived from the gas undertaking at Neumünster, where one man formerly lighted 70 lanterns by hand, and where 170 Bamag lighters had been employed since June, 1905, the economy amounted to about 5·90 marks per lantern per year. Herr Kern quoted numerous satisfactory opinions passed by the authorities in different towns upon the Bamag apparatus. At Darmstadt, trouble had arisen owing to the frequent extinction of the pilots, but that was undoubtedly due to the faulty construction of the lanterns. At Salzwedel, 200 Bamags were at work on a distributing system some eleven miles long. A wave of pressure equal to 35-10ths was transmitted for a period of two minutes, and acted perfectly. The mantles and chimneys were reported to last one-fifth longer than before. The economy in gas was said to be very marked, and no complaints were received as to the premature or dilatory lighting and extinction of a lamp. At Durlach, 180 Bamags were employed, actuated by a wave of 24-10ths to 35-10ths over a period of two or three minutes. Although the distributing system was somewhat badly dimensioned there, the apparatus worked perfectly, and again no complaints were received from the consumers about the temporary pressure.

After citing a few other gratifying opinions on the "Bamag," Herr Kern went on to describe the "Rostin" lighter, which, so to speak, differed from the Bamag as a wet meter differed from a dry. In the Rostin lighter the wave of pressure first opened two floating valves, whose movement suddenly admitted the pressure to the bell of the apparatus which floated in mercury, the movement of the latter also actuating the lighting arrangement quite suddenly. By this system of construction, even a comparatively weak pressure wave would actuate a cock that did not move very freely. In the Rostin apparatus it was necessary that the wave should last for about ten minutes, and that the pressure between the lighting and the extinguishing waves should fall to the normal amount. Furthermore, the adjustment of the Rostin was very troublesome, and it occupied twice as much space and cost twice as much money as the Bamag. Experiments had been in progress in Mannheim since 1905 with this particular form of lighter, but had not yet yielded satisfactory results. Nevertheless Herr Kern understood that the Rostin was employed largely in England, and was becoming a successful competitor to the Bamag. The author felt some objection to any apparatus requiring the use of mercury or glycerine, and he considered, moreover, that any lighter ought to be so arranged that the gas could be led round it and the flame turned up and down by hand.

Himmel, of Tubingen, has designed a distance lighter which is very compact, strong, and cheap, costing only some 25 marks. The "Himmel" lighter consisted of a horizontal lever actuated by the movements of a horizontal diaphragm exposed to the pressure. The mechanism also comprised a pair of levers which opened or closed the main valve; one of them being provided with a tripping device which masked its driving pin so that the second wave of pressure did not extinguish those burners that were intended to remain alight all night. When, however, the second wave raised the lever to its highest point, the tripping gear was knocked on one side; and therefore on its next rise, the pin threw over the main lever and closed the gas-cock. The whole lighter was placed in parallel with the main gas-way, so that any lantern could be lighted or extinguished by hand. Herr Kern believed that the Himmel apparatus would prove successful when adopted on a large scale.

The author concluded his paper by referring to a few less known distance lighters, first singling out for mention the "Lichtwart," designed by Herr Brocl, of Velbert, where some seventy specimens had been in use for about two years. The lighter comprised a bell floating in mercury and so weighted as to be raised by a wave of pressure only 6-10ths above the normal maximum. Through the agency of a ratchet, the rise of the bell moved a

* See "JOURNAL," Vol. XCVII., p. 604.

* See *ante*, p. 568.

wheel forward one-sixth of a revolution. On the same spindle was a second detachable wheel carrying a number of pins adjustable in position and number. These pins moved the gas-cock in the manner and at the times desired; and since two such wheels could be applied to each lighter, two burners in any one lantern could be extinguished at different times. The lighter could be cleaned in position by using alcohol or benzol. The Lichtwart would work with 170 grammes of mercury, whereas the Rostin required 800 grammes.

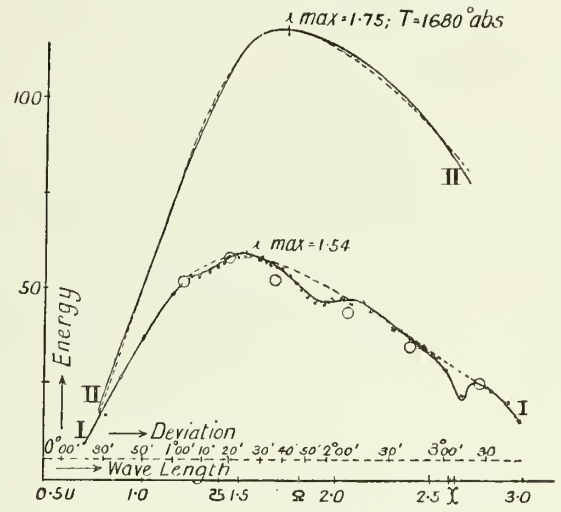
An apparatus called the "Schwarzkopf" designed by Herr Burgemeister, of Celle, had been successfully tried in Landsberg. It was characterized by possessing no mechanism at all, and was perhaps even too simple. The lighter consisted of a receptacle filled to a certain height with glycerine, through which the service-pipe passed almost to the top. Inverted over the pipe was a small bell, having an S-shaped tube within it, which acted as a hydraulic seal. When the pressure was normal, the tube was full of glycerine and prevented the gas from passing to the burner. On the arrival of a wave of positive pressure, the glycerine was forced out of the tube, and the gas reached the burner. When the pressure fell to its normal value again the burner continued alight, because the level of the glycerine in the bell was still depressed below the mouth of the S tube. In order to extinguish the burner, a wave of negative pressure was sent through the main for a few moments. This caused the glycerine to be drawn back under the bell so as to seal the tube—a quantity of liquid entering the latter and remaining there until the next wave of positive pressure was sent out. The apparatus was rather difficult to adjust at first, but worked well when adjusted properly. It seemed questionable, however, whether the sudden reduction in pressure would not introduce various troubles, especially with inverted burners.

Herr Kern also said a few words in favour of the "Nebendahl," the "Milbert," and the "Pharos" lighters, but could not regard apparatus requiring a pneumatic or electric attachment to each street-lamp as being successful competitors with the others or fit for the control of inverted burners.

TEMPERATURE OF INCANDESCENT PARTICLES IN LUMINOUS FLAMES.

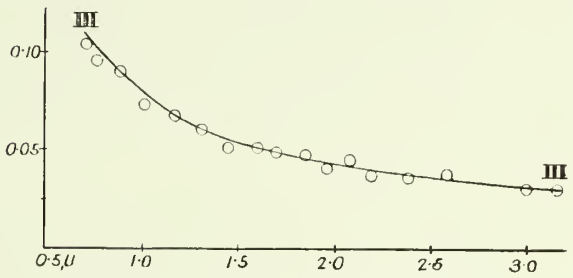
Some experiments have been carried out recently by Herr Rudolf Ladenburg, at the Technical High School at Charlottenburg, upon the emissive and absorptive power of various luminous flames. An account of his processes and results was published a short time ago in the "Physikalische Zeitschrift," from which the following particulars are obtained.

The object of the research was to ascertain the relationship between the absorptive power of the incandescent particles of carbon in a flame and the wave length of the light; thence to calculate the energy phenomena of a "black" body possessing the same temperature as the carbon particles; and so, with the aid of the emission curve of the flame, to deduce the temperature of the incandescent carbon particles therein. The emission curve of the flame was ascertained by means of a Rubens mirror spectrometer, a quartz prism with an angle of 60°, a thermopile, and a Panzer galvanometer—the results obtained being reduced in the usual manner for the normal spectrum. The image of the flame was thrown from a concave mirror upon the slit, so that only an accurately defined portion of the flame was used for the investigation. [Herr Ladenburg remarks that, in the region studied, quartz disperses so uniformly that no displacement of the maximum is introduced through the breadth of the thermopile or of the slit. Stewart found considerable displacement; but he employed a prism of fluorspar.] In order to measure the absorption of the flames, the rays of a Nernst lamp were thrown, by means of a concave mirror, upon a slit 1 m.m. wide and 5 m.m. long; the image of the slit being reflected from a second concave mirror upon the slit of the spectrometer, whence the light was reflected by a third concave mirror into the prism, and finally was reflected again from a plane mirror on to the thermopile. The flame under examination was placed in front of the first slit in such a position as to present to the Nernst light the portion of the flame whose emissive power was to be determined. The energy of the flame itself, of the Nernst lamp (when the effective width of the slit was gradually changed between 0·1 and 1·0 m.m.), and the energy of the Nernst lamp *plus* the energy of the flame, &c., were determined for each wave length over the whole region between 0·7 and 3·1 μ. The Nernst lamp was supplied with current from fifty accumulators; and during the investigation at each wave length, which occupied from three to five minutes, its intensity did not vary more than $\pm \frac{1}{4}$ per cent.—the heating of the slit producing no effect upon the thermopile. Nevertheless, the accidental variations in the flame were such that the individual measurements could not be carried out more precisely than to within $\frac{1}{2}$ per cent. of the energy emitted. The flames that were examined were firstly that of a standard Hefner lamp, and secondly that of acetylene consumed at a double steatite burner so placed in regard to the axis of observation that the flat side of the flame presented an angle of 45° thereto. The acetylene was generated from carbide of calcium, purified with "acagine" [a proprietary mixture of bleaching powder with lead chromate], and then passed



I. Energy Distribution of the Hefner Flame for Normal Light.
II. ,, ,, ,, "Black" Flame.

Fig. 1.



III. Total Absorption of the Hefner Flame.

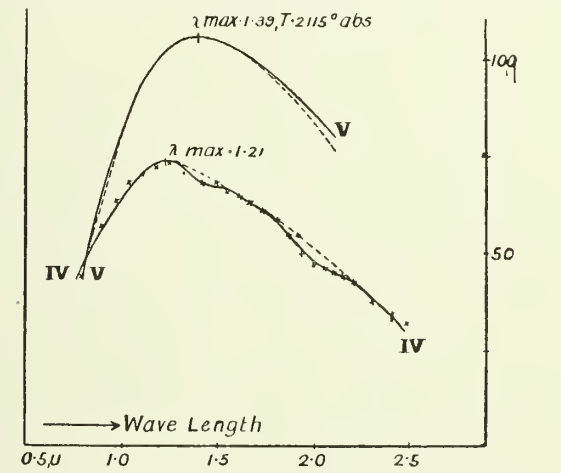
Fig. 2.

through two vessels charged with quicklime to the burner at a pressure of 33·4-10ths.

The results obtained on measuring the emissive power of the Hefner flame are plotted on the curve marked I. in fig. 1, where the ordinates indicate the energy, the full-line abscissæ indicate the wave length, and the dotted abscissæ indicate the displacement. A correction has been made for the small absorption within the quartz prism on the basis that a plate 2·25 c.m. thick gave 4 per cent. more absorption at 1·45 and 2·20 μ than at 0·8 μ.

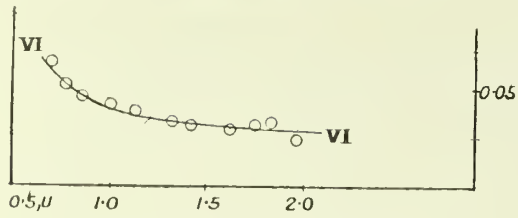
The energy distribution of the Hefner flame has already been determined by Angström, who employed a prism of rock salt. Some of the values he obtained, reduced to the normal spectrum, are represented by crosses on Curve I. in fig. 1. Curve II. in fig. 1 represents the energy distribution of the "black" Hefner flame. Fig. 3 is precisely similar to fig. 1, but relates to the acetylene flame; Curve IV. being that of the normal flame and Curve V. that of the "black" flame. Stewart has already examined the emissive power of the acetylene flame, using a prism of fluorspar; but at the position of maximum radiation (about 1·2 μ) the latter disperses so irregularly that Stewart's results cannot be compared with those obtained by Ladenburg. In the region under examination, only the fainter absorption bands due to the carbon dioxide and the water vapour of the atmosphere are present. In order to eliminate their influence, the curves have been smoothed in the manner shown by the dotted lines in the lower curves of figs. 1 and 3.

The absorptive power of the Hefner flame as obtained from numerous examinations is shown in fig. 2, where the ordinates are the absorption and the abscissæ the wave lengths. Fig. 4 similarly represents the total absorption of the acetylene flame.



IV. Energy Distribution of the Acetylene Flame for Normal Light.
V. ,, ,, ,, "Black" Flame.

Fig. 3.



VI. Total Absorption of the Acetylene Flame.

Fig. 4.

On dividing the emissive powers of the flames deduced after smoothing out the atmospheric absorptions by the corresponding absorptive powers, the "black" energy curves already mentioned are obtained—that is to say, the energy curves of bodies which possess unit absorptive power at the temperatures of the incandescent carbon particles in the respective flames. The dotted lines accompanying the "black" curves in each of the two figures show the calculated emissive power of a "black" body whose maximum lies at the same spot; and the satisfactory agreement between the dotted and the full-lines shows the excellence of the method employed. The equation $\lambda \max T = 2940$ represents the temperature of the incandescent carbon in the Hefner flame as being 1678 deg. abs. = 1405 deg. C., and that of the carbon in the acetylene flame as being 2115 deg. abs. = 1842 deg. C.

With the aid of the absorptions, the temperatures of the flames may also be easily and accurately calculated on determining the "black" temperature with the help of the optical pyrometer. If T_s is the "black" temperature of an incandescent body at the wave length λ, T_w its true temperature, and A its coefficient of absorption, then

$$\frac{1}{T_w} = \frac{1}{T_s} + \frac{\lambda}{c} ln\, A;$$

where $c = 14600$. When a Hefner lamp verified by the Reichsaustalt was employed in conjunction with a red glass having the wave length 0·66 μ, the Hefner light gave an average value of $T_s = 1174$ deg. C., and the acetylene light $T_s = 1388$ deg. C. Neglecting the reflection due to the absorption at 0·66 μ, the absorption curve of the Hefner light gave A = 0·110, and that of the acetylene flame A = 0·064. So that, from the equation, the temperature of the former was $T_w = 1694$ deg. abs. = 1421 deg. C., and that of the acetylene was $T_w = 2093$ deg. abs. = 1820 deg. C. Making an allowance for reflection in the Hefner flame of 0·01, and in the acetylene flame of 0·006, the values became

$$T_w = 1704° \text{ abs.} = 1431° \text{ C.}$$

for the Hefner light and

$$T_w = 2111° \text{ abs.} = 1838° \text{ C.}$$

or the acetylene light.

These temperatures agree well with that found by Kurlbaum for the Hefner light (1427° C.) and by Nichols for acetylene (1845° C.), though the latter worked with a thermo-electric process, keeping his thermocouple outside the flame and calculating his results by extrapolation.

USE OF PITCH FOR MAKING PAVING BLOCKS.

In the manufacture of artificial asphalt, powdered silica is usually compressed with bitumen or pitch. The cementing material is first melted, and then as large a quantity of silica dust as possible is added by hand. At the place where the paving is being laid, the blocks of asphalt are again melted, and as much sand is added as requisite to form a good asphalt. Notwithstanding this, the quantity of the cementing substance is so great that the product is very sensitive to variations of temperature and pressure. To form a true artificial stone having a pitch and silica base in different properties to those of asphalt, it is preferable to make the pitch act directly on the silica.

A mixture of powdered pitch and silica dust, in the proportion of 16 and 84 per cent. respectively, is placed in a semi-cylindrical mechanical mixer, fixed horizontally, and open at the top. This mixer, which is about 16 feet long, and furnished with a helical cast-iron agitator, is stood on a fireplace protected by refractory bricks. The mixture is introduced by means of a bucket elevator. The silica should be half fine dust and half granular, so as to economize the pitch and obtain a maximum density in the product; for the dust fills the interstices left by the grains. The temperature of the mixture is maintained at about 150° C., so that the pitch does not boil, and always remains pasty.

The prepared powder is automatically conveyed from the mixer to a powerful hydraulic press, having a piston about 14 inches in diameter, by small helical shovels working like an endless screw. This press, which has a rotating circular plate 6 ft. 6 in. diameter, contains three moulds, 10 inches square, arranged at an angle of 120° with regard to each other; an accumulator, to increase the speed of pressure; and a hydraulic pump. The plate turns upon its centre round a column of the press. Each mould has a compressing block, and is 6 inches deep. The first mould receives the material, and the second (located under the press piston) reduces the powder to a compressed block about 3 inches thick. The third mould, under the action of an automatic discharger connected with the piston, effects a clearance. When cold, these siliceous blocks resemble dark grey basaltic compressed blocks. If they are laid with joints of pitch, the resulting pavement is practically in one piece.

The foregoing particulars are taken from an article in a recent number of the "Revue des Produits Chimiques," which contains an estimate of the expense of producing the blocks. It is claimed that their cost per square metre is lower than that of other methods of paving, and even of common macadam. It is stated that silica compressed by the system described retains all the qualities of asphalt—viz., a certain malleability and elasticity which prevents crumbling. It will also deaden sound and act as an insulator; while its composition imparts to it considerable disinfecting power. Its specific gravity (2·391) is much greater than that of asphalt (1·366), and slightly less than that of granite (2·716), depending upon the purity of the silica employed and the pressure used. By its hardness and the small percentage of bituminous properties, the pavement is not slippery like asphalt, and it has the good qualities of stone, without being friable under the action of impact or frost. The material can be used for roads, side-walks, laboratories, cellars, waterproof buildings, drains, and terraces.

The parties most interested in this subject are brick and cement makers, who already have the necessary machinery, and tar distillers and asphalt manufacturers, who possess the raw materials. Complete plant for the production of these paving blocks has been fitted up by the Société des Produits du Goudron Portalupi, in Turin, and hand plant has been installed at Vitry.

A REINFORCED CONCRETE WATER-TOWER.

In reconstructing the water-works for the city of Anaheim, in Southern California, the problem of a structure for an elevated water supply was one that had to be solved—the immediately surrounding country being very level, with no natural reservoir site available. The population supplied is about 3500, and it was necessary to have a storage capacity of 175,000 gallons, with a minimum head of about 60 feet. Tenders were invited upon specifications for an elevated hemispherical-bottom steel tank on steel towers, and for a tank and tower of monolithic reinforced concrete construction. The specifications for the concrete tanks required that bidders must be able to show successful examples of this method of construction. The tenders for steel tanks and towers ranged from $9200 to $12,500; while for the reinforced concrete tank and towers two offers were received—one for $10,400, which was accepted, and the other much higher. The greater durability, the reduced cost of maintenance, and the better appearance led the City Trustees to accept the reinforced concrete structure, the following particulars in regard to which are taken from "Engineering Record."

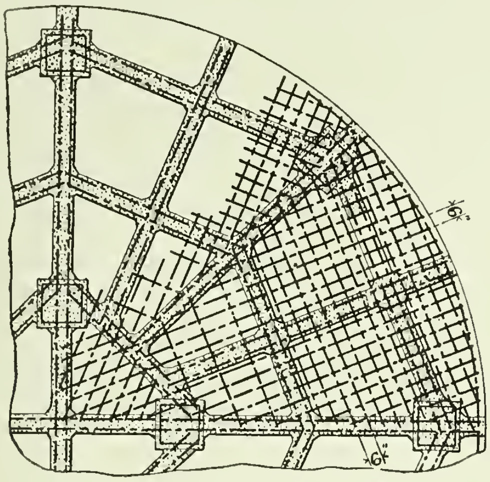
The tank is approximately 30 ft. 3 in. diameter, and has a clear interior depth of 32 feet. It rests on twelve reinforced concrete columns, each 22 inches square and 60 ft. 2 in. long—eight of them being placed at equal distances on the circumference of a 33-feet circle, and the other four on the circumference of a 4 ft. 4 in. circle. The columns are braced by two series of horizontal struts at the third points of their length; but no diagonal bracing in vertical planes is used, as the batter of the columns and the manner in which they are built into the foundation slab and the tank floor are intended to provide for the lack of it. The horizontal struts contribute to the rigidity of the tower, by dividing the columns in effect into three compression members.

The soil at Anaheim is an alluvial deposit underlaid with strata of sand to a depth of 50 feet, and in periods of great rains these strata are said to resemble quicksand. This led to the adoption of a very conservative foundation bearing pressure. Holes sunk near the spot showed that the first stratum of sand was about 8 feet below the surface. The excavation is carried down 6 feet; and in case sand should be encountered at that depth, it is to be removed for 18 inches and replaced by soil or clay.

The reinforcement consists throughout of twisted square steel bars tied together where necessary with $\frac{1}{4}$-inch round iron. The steel is to have an elastic limit of about 40,000 lbs. per square inch before twisting, and about 60,000 lbs. after twisting, and an ultimate strength of 80,000 lbs. Extra care is required in placing the steel in its proper position, and more especially to prevent any movement of the reinforcement while concrete is being placed. All joints between adjacent continuous rods in tension are to be lapped 12 inches, and bound together by wrapping them with soft steel wire.

The foundation consists of a reinforced concrete slab, 36 inches thick and 37 feet square, extending out beyond the limits of the tower and tank on all sides. It is made of 1 to 3 to $4\frac{1}{2}$ concrete; the crushed rock or gravel varying in size from $\frac{1}{4}$-inch to 3 inches in the largest dimension, and is reinforced by twisted steel bars placed 2 inches from the underside of the slab. The bottom bars are of $\frac{3}{8}$-inch material, 16 inches on centres; and at right angles to them are placed the distribution bars of $\frac{3}{8}$-inch material, 12 inches on centres. On top of this foundation slab are built the pyramidal pedestals of the columns, which are anchored to the slab by the twisted steel bars running through them, and embedded in

the concrete of the foundation. The columns are reinforced with four $\frac{3}{4}$-inch twisted bars, one in each corner, tied together with $\frac{1}{4}$-inch iron wire. When the tank is empty, the assumed wind pressure is sufficient to cause tension in the columns; and the vertical reinforcing in the latter is therefore designed to resist both compression and tension. The ends of adjacent rods are kept in line by being placed in a socket about 12 inches long; and, in order to resist tension, they are joined by a splicing-bar of twisted square steel about 48 inches long, firmly bound to them with soft steel wire. The columns and girders are made of 1 to $2\frac{1}{2}$ to $2\frac{1}{2}$ concrete, using the run of the crusher under $\frac{3}{4}$ inch for the stone. The struts have a cross-section 14 inches by 16 inches, and are reinforced with four twisted bars of either $\frac{1}{2}$-inch or $\frac{5}{8}$-inch material, one being placed in each corner and tied together, as explained for the columns.



Floor and Girders at Bottom of Tank.

By far the most complicated part of the reinforcement consists in the beams and girders supporting the floor of the tank. Most of these, which are shown in the accompanying illustration, are 8 inches wide, varying in depth from 12 to 16 inches. The placing of the reinforcement in them does not differ from the standard methods, except that the stirrups of $\frac{1}{4}$-inch wires are used quite plentifully. The floor of the tank is 6 inches thick, reinforced with $\frac{3}{8}$-inch bars arranged with varying centres according to the span; the greater part of them being placed in a right-angled grid on 6-inch centres both ways.

The sides of the tank vary in thickness from 6 inches at the bottom to 4 inches at the top; and, like the floor, they are made of 1 to 2 to 2 concrete, the stone being the run of the crusher under $\frac{1}{2}$-inch. In case the rock should vary to such an extent as to give a more dense concrete if mixed in some other proportion, the amount of sand and rock will be varied accordingly. The reinforcement of the sides consists of $\frac{1}{4}$-inch twisted steel bars placed vertically on 24-inch centres around the circumference of the tank, running from the floor to the roof, across which, laid horizontally and continuously around the tank as a hoop, are $\frac{3}{4}$-inch twisted steel bars with centres varying from $3\frac{1}{2}$ to 12 inches. For the lower half of the height of the tank these hoop bars are of $\frac{3}{4}$-inch steel; for the next 5 feet, $\frac{5}{8}$-inch steel; and for the remainder of the height, $\frac{1}{2}$-inch steel. The spacing of the $\frac{3}{4}$-inch bars varies from $3\frac{1}{2}$ to 7 inches; of the $\frac{5}{8}$-inch bars, from 5 to 7 inches; and of the $\frac{1}{2}$-inch bars, from 5 to 12 inches—the smaller spacing, of course, being used in the lower part of the section containing a bar of given size.

The roof is a flat cone, having a rise of only 12 inches, and is carried by eight radial reinforced concrete girders, varying in depth from 9 to 15 inches. The roof is 2 inches thick, reinforced with $\frac{1}{4}$-inch twisted steel rods laid both radially and perpendicular to the radii; the latter bars reaching between the girders which support the roof. The spacing of the bars laid crosswise of the radial ones varies from 3 inches near the edge of the tank, where the span between the girders is longest, to 12 inches near the centre, where the span is very short. A steel ladder allows access from the ground to the tank.

The waterproofing of the tank is considered the most particular part of the work. Every effort will be made to prevent lack of continuity in the walls due to cessation of work from day to day. The inside of the tank is to receive a waterproofing coat, $\frac{1}{2}$-inch thick, composed of 1 to 1 cement grout. Of the cement used, 96 per cent. must pass a 100-mesh screen, and 82 per cent. a 200-mesh one. The contractors will also use some astringent to aid the waterproofing. The tank is to be kept filled with water for ten days before acceptance, during which time it must not develop any structural weakness nor any objectionable leakage.

The value of land taken for water-works purposes, according to a decision of the Massachusetts Supreme Judicial Court, is made up of the value of the land, apart from its special adaptability for water-supply purposes, *plus* such sum as a purchaser would add to that value on the chance that the land might be some day used as a water supply.

REGISTER OF PATENTS.

Incandescent Mantles and Holders.

Wildbore, J. E., of Oldham.

No. 17,867; Aug. 9, 1906.

The improvements referred to in this specification consist of the mantles being hardened at the bottom by being dipped in a solution which does not burn when the mantle is lit. It therefore stops mantles from splitting upwards from the bottom, but "does not affect the illuminating power of the mantle in the least." The stand is adjustable and fits on to the burner and supports the mantle from the bottom—an arrangement only possible with hardened mantles.

The solution described is a mixture of plumbago, French chalk, and flour, mized to a paste; but the patentee does not confine himself to this particular method of hardening mantles.

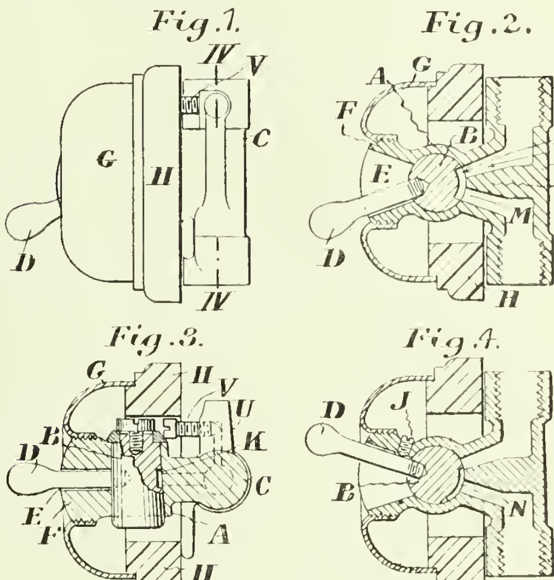
Gas Cocks or Valves.

Glover, T., of Norwich, Wayte, W. H., of Norwich, and Hands, G., of Farringdon Road, E.C.

No. 18,625; Aug. 20, 1906.

This invention relates to cocks or valves for operating gas-lights (principally at a distance); the chief object aimed at being to construct a valve or cock for fixing on a gas supply to facilitate the turning on of the full supply to burners, to entirely cut off the supply, or to reduce it to the quantity required for a pilot-burner—all without touching the gas brackets or the like.

The patentees remark: It is well known that the tumbler switch for controlling the flow of an electric current for lighting rooms is most convenient and tends to economy in the use of current—especially when the switch is fixed near the door of a room. A gas valve constructed according to this invention may suitably have the same appearance; is operated in the same way as a tumbler switch; and gives like facilities in the control of gas lights as the switch affords for the control of electric current.



Glover, Wayte, and Hands' Gas-Cock.

Fig. 1 is an elevation of a gas-cock constructed according to this in vention; fig. 2 is a vertical section; fig. 3 is a plan; and fig. 4 shows in vertical section the valve slightly open when the switch handle is pushed back to its fullest extent so as to allow sufficient gas to pass to supply a pilot-burner.

The longitudinal axis of the barrel A and of the taper plug B are at right angles to the longitudinal axis of the casing C through which the gas is supplied; and the plane in which the axis of the plug lies is parallel to, but at some distance from, the plane in which lies the axis of the casing, and consequently also the axis of the supply pipe, which is in line with it. Thus when the casing is fixed to a wall, the plug is at some distance from it; thus rendering it readily accessible for adjustment and repairs without its being necessary to touch the wall or the rest of the installation. The barrel and casing are made of one casting, and the plug mounted therein is operated by a handle or lever D secured thereto by screwing. The amount of movement allowed to the lever is limited by the size of the slot E in the raised boss F forming part of the barrel of the cock; the boss being also provided with an external thread on to which is screwed a dome-shaped cover G having a central internally threaded sleeve or cylindrical part. The dome-shaped cover while improving the appearance of the cock also serves to retain in position the wooden block or base H.

The casing is screwed internally at each end, to receive the gas-pipes. It is provided at about the middle with a perpendicular wall I which extends as far as the plug, so as to make joint therewith; and the latter has a gas-way in the form of a slot K adapted to register with the ports L and M in the casing. There is a passage or bye-pass U, with a regulating screw V so as to admit enough gas to light a pilot-burner; the supply to the main burner being closed by a valve in or near the burner operating automatically when the pressure of the gas thereto is materially decreased.

It is to be understood that a valve or cock which permits of a sufficient amount of gas passing even when the plug is closed is well known, and that this figure only shows how a valve constructed according to this invention may be adapted for use with a burner provided with a pilot-burner, and having a valve which closes the supply to the burner automatically when the area of the passage of the gas through the cock, and consequently the pressure of the gas in the pipe from the cock to the burner, is considerably reduced.

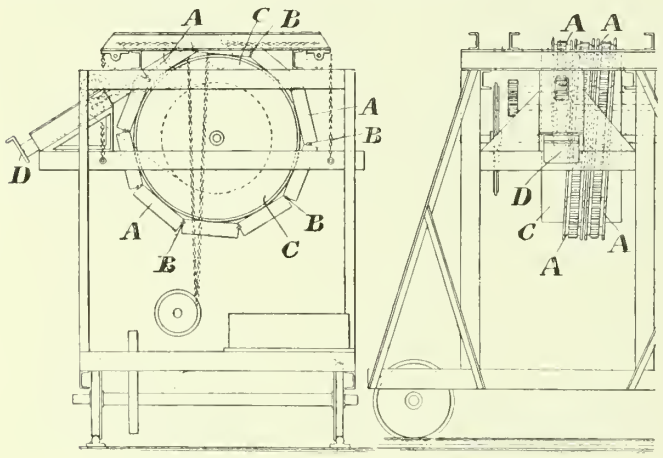
The construction shown in fig. 4 is similar to that described except that the recess or slot N in the plug B is open to a slight extent (even when the lever is pushed back), so as to allow just enough gas to pass to supply the pilot-burner—the amount of opening of the plug when in its closed position being regulated by a set-screw J.

Discharger for Gas-Retorts.

Ludbrook, S. W., of Hornchurch, Essex, and Cole, W. L., of Burdett Road, Bow.

No. 20,325; Sept. 12, 1906.

This invention relates to the class of gas-retort discharger described in patent No. 14,980 of 1905, in which the discharger rod or pusher bar is made in two sections, jointed together end-on; the present proposal being to construct the pusher rod or bar from a number of sections hinged together, so that they can "be wrapped around a drum or coiled in the apparatus carrying same to economize space."



Ludbrook and Cole's Retort Discharger.

The illustrations show a side elevation of a portion of a framework carrying the present construction of discharge rod, and a front elevation.

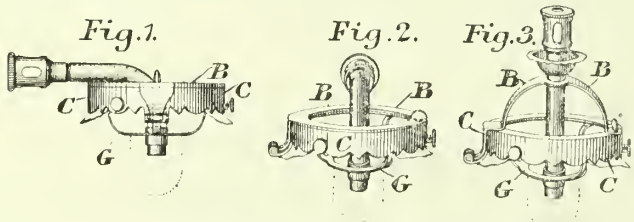
As shown, the pusher bar is made from a number of sections A, jointed together end-on at B; and such sections when not formed up in a straight line to constitute the pusher rod are wrapped around a drum C. But the sections can, it is pointed out, be coiled or conducted in any other manner to effect the same object. D is the pusher-head, which, with the bar, is passed into the retort to eject the coke.

Inverted Incandescent Gas-Burners.

Booth, J., Topping, R., and Simpson, R. J., all of Birmingham.

No. 25,794; Nov. 15, 1906.

These improvements have for their object to facilitate the replacing of mantles on the burners when required, without any waiting for the parts of the burner to cool, and thus obviating waste of time. The burner is made with a fixed gallery and also with a hinged globe-carrying ring, as shown.



Booth, Topping, and Simpson's Inverted Burners.

Fig. 1 represents in side elevation, and fig. 2 in front elevation, an inverted incandescent gas-burner (provided with the improvements) for connection with fittings which project horizontally. Fig. 3 represents the improvements applied to burners which depend vertically from the gas-fitting.

The hinged globe-carrying gallery C in figs. 1 and 2 is retained in its normal or raised position by a swivelling stud or turn button carried by the gallery passing through a slot in the fixed gallery B and being so turned that its head crosses the slot. In fig. 3, the vertical burner-tube has fixed to it a crossing-strap or bar B, to part of which the globe-carrying gallery C is hinged; the other half having the slot for the swivelling stud or turn button on the gallery to engage with.

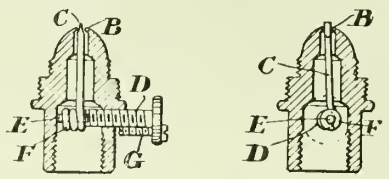
The mantle may be supported either on the ring G attached to the globe-carrying gallery or on the ordinary mantle support on the end of the burner.

Regulator for Incandescent Burners.

Harwood, B. E., of Finsbury Park, N.

No. 28,033; Dec. 8, 1906.

This invention relates to the combination with the gas-nozzle of an atmospheric burner for incandescent gas lighting of a pin valve having a tapered or inclined end which is inserted into the orifice of the nozzle, while an eye is formed at the inner end of the pin-valve and an eccentric pin engages with the eye.



Harwood's Regulator for Incandescent Burners.

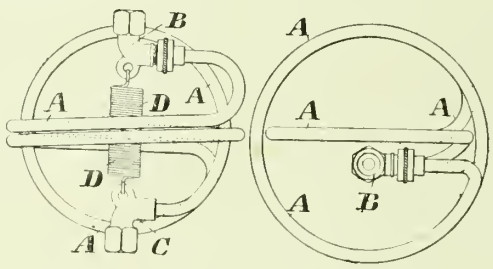
The nozzle proper has in it a hole B through which the gas enters the mixing chamber of the burner which is screwed on to the nozzle. C is the pin-valve arranged inside the nozzle and inserted into B—the outer end of the pin-valve being made tapering or inclined, so that its longitudinal movement in the hole will serve for contracting or increasing the area of the gas passage. D is a screw provided at one end with an eccentric pin E which enters an eye F formed at the inner end of the pin-valve. By rotating this screw in one or the other direction, the valve is moved longitudinally to the required extent for regulating the gas supply. In order to prevent the screw from being rotated out of engagement with the pin-valve, a stop G is inserted through the head of the screw and impinges against the underside of a shoulder formed on the exterior of the nozzle.

Anti-Vibration Appliances for Gas-Lamps.

Glover, T., of Queen Victoria Street, E.C.

No. 29,573; Dec. 28, 1906.

This invention relates to an anti-vibration device which consists of a coil of piping having the connections for the gas supply-pipe and the burner at the ends, as shown.



Glover's Anti-Vibration Gas-Lamp Device.

The copper or other tube A with its connections B C. join up the supply pipe and burner. The pipe A has as many coils as desirable, at an angle to each other, so that the vibration of the burner is taken up by the coil in any position of the burner.

Some coils may be vertical, others horizontal (as shown), while others may be at an angle. But it is preferable, says the patentee, that each coil should be on a different axis, but from one imaginary centre; and the coils may be of different sizes, and some arranged within the others.

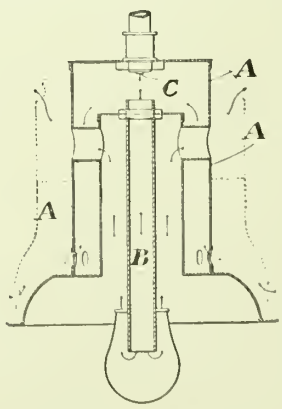
The attachments B C on the ends of the pipe A are connected by a helical spring D passing through the coils, so as to support the weight of the lamp.

Incandescent Gas-Lamps.

Tweedie, R. O., of Galashiels, N.B.

No. 1235; Jan. 17, 1907.

This invention relates to incandescent gas-lamps of the kind wherein the air heated in an enclosed chamber by the waste gases, and so raised to a certain degree of compression, is led into a bunsen burner tube carrying an inverted mantle.



Tweedie's Incandescent Lamp.

The bunsen tube B receives its gas supply from a nozzle C. Depending from the gas-pipe, and concentric with the tube B, is the air-heating chamber A, which extends from the nozzle C to the level of the upper end of the reflector E—surrounding the upper major portion of the tube B. Surrounding B, and enclosed by the chamber A, is a flue for

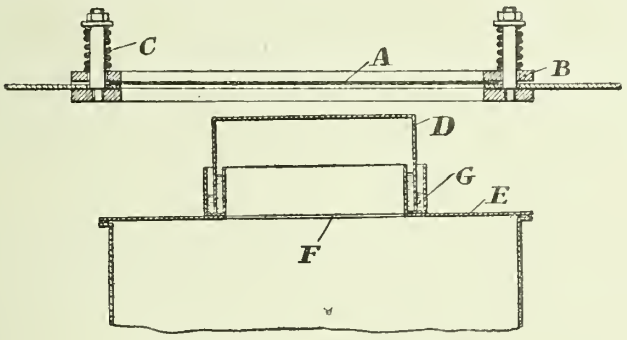
the waste gases, extending from the base of the chamber A almost to the level of the upper end of the tube B. The air-heating chamber is closed at both its upper and lower ends, and the flue is closed at its upper end; while between the upper end of the flue and the upper end of the chamber A is a space "of considerable dimensions" into which opens the upper end of the tube B. The air is admitted to the chamber A through orifices at the lower end fitted with the usual hit-and-miss governor, and outlets are provided at the upper end for the escape of the products of combustion from the flue.

Safety Devices for Use in Purifiers.

MÜNZEL, M., of Brunswick, Germany.

No. 10,752; May 8, 1907.

The purifiers which are used in suction gas apparatus cannot (the patentee remarks), in consequence of their large dimensions except at a comparatively high cost, be constructed sufficiently strong to withstand with safety explosions of oxyhydrogen gas. The safety devices hitherto employed to prevent the formation of too high explosion pressures have, it is said, considerable drawbacks—water seals by reason of their comparatively large water mass having too great inertia, so that under certain circumstances the full explosion pressure may already be developed before the water is ejected; while valves of the usual construction are also too heavy if they are to remain permanently tight, and have the necessary size. The patentee therefore proposes to overcome these difficulties by arranging a spring-pressed plate or disc on the purifier of comparatively small dimensions, or a water-sealed bell of much smaller dimensions.



Munzel's Purifier Safety Seal Device.

A thin plate A of sheet iron, sheet lead, pasteboard, indiarubber (with or without canvas insertion), mica or other suitable material is pressed by a ring B and springs C against the cover of the purifier. "In the event of an explosion, according to its suddenness and the rigidity of the plate A, the latter, together with the ring B, will lift like a safety valve, or will bend into a spherical dished shape and fly out. In any case only a comparatively small mass has to be set in motion." According to the material of which the plate is composed, it may either itself serve as packing or packing material must be placed beneath it.

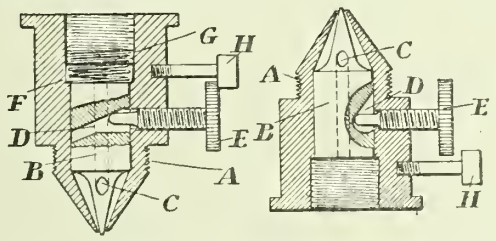
In the alternative form of construction, an aperture F formed in the upper cover E of the purifier is surrounded by an annular channel G. A bell D in this channel is filled with water or other fluid; and in combination with the liquid hermetically shuts off the interior of the purifier from the outside. "As during the regular working there is a low pressure in the purifier, the liquid in the channel G stands higher inside the bell than outside; but if an explosion takes place the liquid from the channel G is ejected to the outside, or the bell is raised or entirely blown off according to the strength of the explosion."

Adjustable Jets for Air-Gas Burners.

BRETT, C. G., and HENNEBERGER, F., of Tooting, Surrey.

No. 12,153; May 25, 1907.

In this air-gas burner the passage through the jet is controlled by a slide movable in one direction by its weight or by a spring, and in the opposite direction by turning a screw the end of which bears against an inclined surface in or on the slide.



Brett and Henneberger's Adjustable Gas-Burner Jets.

The illustration shows a vertical section of a jet suitable for an upright burner and one for an inverted burner.

In the former, the cylindrical jet A is internally coned at its upper end; the orifice of the jet being at the apex of the cone. Having a sliding fit in the cylindrical portion of the jet is a cylindrical plug B, also coned at its upper end—the angle of the cone being somewhat smaller than that of the internal cone of the jet, so that the sharply-pointed apex of the cone can protrude through the orifice of the jet, and leave a chamber between the coned end of the internal slide and the cone of the jet. The plug has longitudinal perforations C and a lateral cavity or transverse hole D, the upper surface of which slopes downwards towards the axis of the cone. The plug is inserted into the jet so that the cavity D is opposite to the end of a screw E working through the wall of the jet. When this screw is turned so as to make its end protrude farther into the jet, the end rides against the inclined surface of the cavity D, and lifts the plug to close more or less completely the jet orifice; while when it is turned in the opposite direction the screw allows the plug to slide downwards to open the orifice more or less. Where the jet is exposed to much dirt, a spiral spring may be introduced between the cone of the plug and the internal cone of the jet, so as to aid the weight of the plug in opening the orifice.

In the inverted arrangement, a spring F, having this function of aiding the weight of the plug, is shown applied between the flat end of the plug and a ring G screwed into the jet. In this case, the plug moves under the action of its weight to close the orifice of the jet—the spring only being used when this weight is likely to be insufficient to overcome any deposit in the jet.

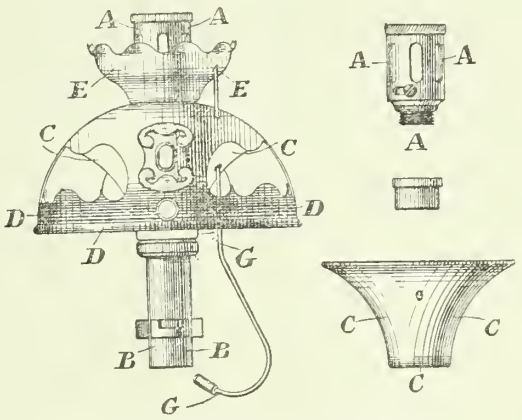
In order that the manipulator may not withdraw the screw far enough for it to become disengaged from the cavity D, a pin H is fixed in the wall of the jet so that its head limits the movement of the head of the screw.

Gas-Fittings.

SPERRYN, G. N., and SPERRYN AND COMPANY, LIMITED, of Birmingham.

No. 12,716; June 1, 1907.

This invention refers to fittings used for inverted burners—to obviate the trouble experienced owing to heating of the parts of the fitting above, and in the neighbourhood of, the burner.



Sperryn's Gas-Fitting for Inverted Burners.

A is the usual mixing-chamber having an internally threaded upper end for connection to a gas-pipe; B is the burner of refractory material; C is the heat deflector; D is an ornamental cover for it; and E is an ornamental shield arranged on the cover and serving to further protect the mixing-chamber. This china or other deflector C is made separate from the burner, and so that it can be readily arranged in position or removed from same. For this purpose, the burner has a lip at the top, over which is spun a metal cap having an upturned flange for carrying a thread. Into the metal cap the tube F is threaded and forms part of the burner-tube. The deflector is slipped over the tube, taking a seating on the covered lip of the burner. The upper end of the tube is then screwed into a hollow nut, and the cover is slipped in position with also the shield E. The mixing-chamber is then screwed home into the nut—securing the fitting properly together. When a bye-pass G is used, it projects through perforations in the shield E and cover D.

APPLICATIONS FOR LETTERS PATENT.

19,113.—PENDLEBURY, H. A., "Conduits for gas and water." Aug. 26.
19,173.—MILBOURNE, R. J., "Discharging purifiers." Aug. 26.
19,201.—HELPS, G., "Bunsen burners." Aug. 27.
19,202.—HELPS, G., "Lamps and burners." Aug. 27.
19,228.—WOLTERECK, H. C., "Removal of tarry matter from hot gases." Aug. 27.
19,278.—ALTMAN, J., "Inverted burners." Aug. 27.
19,283.—STEINICKE, G., "Inverted gas-lamps." Aug. 27.
19,287.—BLEICHERT, M. A. & P. M., "Quenching and transporting coke." Aug. 27.
19,298.—DUBOIS, F., and HAMLYN, S. W., "Controlling the flow of gas in connection with gas lighting." Aug. 28.
19,329.—ARKINSTALL, D. & F., "Acetylene generators." Aug. 28.
19,341.—HUMPHREY, H. A., "Raising or forcing liquids." Aug. 28.
19,356.—M'MULLEN, J. A., "Gas-engines." Aug. 28.
19,377.—CLARKSON, J. M., "Gas cooking-stoves." Aug. 29.
19,478.—SUGG, W., & Co., LTD., and WRIGHT, E. SUGG, "Street gas-lanterns." Aug. 30.
19,530.—ASSMANN, F., and STETTIN GASWERKE, G. M. B. H., "Air-gas apparatus." Aug. 31.
19,555.—COLE, H., "Incandescent burners." Aug. 31.

Altrincham District Council and the Gas and Electricity Supply.—The Altrincham District Council have decided to convene a conference of representatives of the Councils of Altrincham, Bowdon, and Hale, for the purpose of drawing up a scheme for the acquisition of the undertakings of the Altrincham Gas Company and the Altrincham Electric Supply Company, Limited, on the basis of a joint and mutual ownership and the creation of a Joint Board of Management. It is stated that the price at which the Gas Company's undertaking was offered to the Council three years ago was £187,000—that fixed by the Directors of the Electric Supply Company being £99,000.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Gas Heating Business Field.

SIR,—Though somewhat averse to utilizing your correspondence columns in a general way, I venture to make a few comments by way of response to your invitation on the above subject. Your editorial in the "JOURNAL" of the 3rd inst. is most timely, and should serve as a further rallying cry to the solution of a problem that has certainly been of a somewhat elusive nature up to the present. I speak in general terms; but there may be exceptions, and such will doubtless come forth and assist in the general solution.

The gas heating business, apart perhaps from cooking, undoubtedly requires separate treatment. In a paper read by myself before the Eastern Counties Gas Managers' Association on April 13, 1905, at Leighton Buzzard, entitled the "Commercial Aspect of Technical Societies,"* I referred, among other subjects, to this very question. Possibly I may be permitted to quote from my prefatory remarks thereon, as follows:—

> Our prime product must be considered more as a means to an end than an end in itself. Our unit is transposed from a given quantity of gas to the energy contained therein as expressed in light, heat, and power; and so long as either of them continues to bring grist to the mill, it must be placed upon the market at prices suited to its (the market's) requirements; each of these uses of gas being treated as a *separate* and *distinct field* for exploitation. Each of these fields has separate and distinct standards of comparison; and, moreover, the varying applications of gas in any one of these fields may again require different treatment.

And again—

> If these sources of gas consumption can be developed in any quantity, it is business that we cannot afford to overlook, and that will prove well worth the cultivation. Still, speaking generally, the development of the gas-fire business has not been undertaken in anything like the same spirit as the cooker business; and those who have given the matter much attention would appear to agree that some special inducements must be offered if this particular field is to be thoroughly exploited.

As a stimulus to exploitation, your startling estimate of the extent of this field of business is of sufficient magnitude to urge us to every effort in its cultivation.

The executive of the undertaking with which I am most intimately connected were some little time before they gauged the conditions of supply of cookers that rendered these acceptable to their customers. But since then the demand has progressed by leaps and bounds; and we appear to be passing through similar stages in the provision and use of gas-fires. Generally speaking, we have failed, so far, to appreciate fully the requirements and different bearings of the gas-fire question; and I must confess to being one of those who have not yet practically met the public want in this respect, though I believe we are on the road to so doing. But the fact remains that, in our own case, while cookers have gone out by hundreds, fires have dribbled out by tens; whereas, if this branch was fully developed, the ratio would be in an inverse direction. Some nine or ten years ago, we in Grantham adopted the system of the sale of gas-fires fixed free with piping up to 30 feet per fire; the complete installation being charged at the list-price of the fire, less liberal discount, and the price of gas remaining the same as for other purposes. After some seven to eight years, an inventory disclosed the fact that the total number of gas-fires in the town was 140 only; while the cookers put out on hire practically during the same period totalled some 2000, among 3300 consumers.

As disclosed in the paper already alluded to, I recognized in the discount meter the most suitable means yet devised for popularizing the gas-fire at the minimum of expense. But the transition from simple sale to simple hire *plus* discount on the gas used, was too radical a step for a Lincolnshire market town; and for the time it was decided to try the effect of simple hire. We restricted this to certain specified fires—any others beyond the list to be supplied either on hire for an agreed minimum period of (say) three years, hire-purchase over five years, or simple sale. The price of gas still remained the same as for lighting purposes, &c. Twenty months' experience of the latter system has resulted in 124 fires being hired, and 8 sold outright; the comparative numbers of consumers, cookers, and fires being at date as under:—

Total consumers	4000
,, cookers	2230
,, fires	272

Clearly, though simple hire has achieved about as much in twenty months as simple sale did in eight years, something more remains to be done to complete the popularizing of fires, even to the numerical extent of cookers; whereas in reality the number of fires in use should be far in excess of that of cookers. I am glad to find that our views coincide on such a momentous matter; for I am more firmly convinced than ever that this lode will not be struck until we adopt some such system of preferential treatment as that provided by the discount meter in conjunction with an acceptable hiring system.

Here, again, the fire business requires different treatment from that of cookers; for whereas quarterly renting of cookers is generally found satisfactory, it is advisable, for obvious reasons, to charge gas-fire rents half yearly, and preferably payable in advance—say, March and September. In our own case, the rent is a sum equal to 15 per cent. per annum on the average net cost of the fire fixed complete. Two-thirds of this is devoted to depreciation, and one-third to interest. The fires are visited once a year, in the autumn, for inspection, and also cleaning and repairs, if necessary.

Your arguments are quite in accord with my own views, and, I believe, the views of many others; but what is wanted is a deeper study of the question by all interested parties, from which alone successful action is sure to spring. My main object in writing thus is to urge upon the Commercial Sections of our District Associations the necessity of giving this question their immediate attention, to the end that a good fillip may be given to the gas-heating business while solid fuels are at a comparatively high figure. Once that stage understood as "popular" is attained, the remainder is easy-going.

Grantham, Sept. 7, 1907. R. G. SHADBOLT.

* See "JOURNAL," Vol. XC., p. 158.

SIR,—Reading your "Editorial" of last Tuesday on the above subject led to the reflection that, had the discovery of the utility of gas for heating purposes been made a hundred years ago, and had its use for illuminating purposes only dawned upon the world some fifty years later, what a wonderfully different aspect the gas industry would have borne to-day. There would have been no quibbling on the question of differential prices; the capital outlay in the manufacture of gas for heating purposes would have been so much less per volume made than that which would have been found requisite fifty years afterwards to meet a demand for lighting, that a differential price would at once have been established, and, wonderful as has been the expansion in the coal gas industry, it is small in comparison with what it would have been. As foreshadowed in your article, there is a scope in domestic heating alone for fully four times the amount of gas at present used for all other purposes; and the selling of gas at a cheaper price for uses other than lighting would not only satisfy prospective consumers, but would increase the profits of the gas undertakings to such an extent as would enable them, without a shadow of doubt, very shortly to give a further reduction both to lighting and heating gas.

That this matter may have the attention which it deserves, and that the same energy may be devoted to the heating gas business as has been given to the "Penny-in-the-Slot" business, is my earnest hope—not simply from the point of view of expansion of business or increase of profit, but also from a belief that it will make life more comfortable in our large cities, which after all is perhaps the ideal that municipal gas undertakings, at least, should most aim to attain for their constituents.

Mawson Chambers, Manchester, Sept. 5, 1907. THOS. G. MARSH.

SIR,—Your article under the above heading reminds me that I received, along with my balance-sheet from the Croydon Gas Company, a reprint of a lecture delivered by Professor Lewes at Croydon, in which he draws the parallel between the cost of coal and the cost of gas for heating purposes. Now this seems to be a very practicable way of looking at the matter, and I feel sure that any information your correspondents can give in this direction would be very valuable, and will indirectly help to stiffen the price of gas companies' shares.

Sept. 6, 1907. SHAREHOLDER.

SIR,—We have had the differential price system in use for a considerable time, and are well satisfied that the system is a thoroughly business-like one. We have been much surprised that it has not been more generally adopted, but feel sure that your article will give the necessary encouragement to those who have been long sitting on the fence. From our experience I am certain that the gas community will be much indebted to you for your timely article.

Sept. 6, 1907. SECRETARY.

[Our correspondents are heartily thanked for their letters on the subject treated upon in our first editorial article last week; and it is hoped that their example will be followed by many others. It is a subject that it is opportune to thresh out well; and the more minds that are set to work upon it, and the wider the discussion, the better. Our correspondents have given additional pegs to those in our article upon which to hang discussion; and our columns are open freely to all who wish to subscribe views or suggestions.—ED. J.G.L.]

Increase in the Price of Gas at Plymouth.—The price of gas in Plymouth and Stonehouse is to be increased next quarter by 2d. per 1000 cubic feet. In making the announcement, the Company say that the increase is rendered necessary by the great advance in the price of coal. The present charge is 1s. 9d. per 1000 cubic feet; gas for motive power being sold at 1s. 6d.

Exmouth Water Supply.—Reference was made at a meeting of the Exmouth District Council last Wednesday to certain correspondence which had been going on as to the water supply, and which was being considered by the Gas and Water Committee. The letters were not read; but a summary of them has been published which shows that they relate to difficulties which have arisen over an effort to obtain an additional supply of water. As the quantity of water in the reservoirs was running low, it was suggested that it should be supplemented by pumping water from the Yettington Brook at East Budleigh. This stream, however, works a mill; and the owner of the mill at once threatened the Council with an action if any water was abstracted to his detriment. In the course of the correspondence which ensued, the Council offered to submit to arbitration the question of any damage which might be done to the mill, while the owner offered to sell to the Council his interest in it. New filter-beds are about to be constructed, and will be completed before next summer; but it will apparently be necessary for the Council to take steps to supplement the present supply. At the meeting last Wednesday, they considered tenders for the works which had been decided upon, comprising the construction of filter-beds, service reservoir, meter-house, and pipe-line, the Surveyor's estimate for which was £3392. The lowest tender was that of Messrs. Hardy, Bate, and Co., for £2747; and this the Council decided to accept. The tender of £1410 of the Sheepbridge Iron Company was also accepted for pipes; and that of Messrs. Blakeborough and Sons, of £259 for valves.

LEGAL INTELLIGENCE.

An Intemperate Foreman and a Considerate Company.

At the Kidderminster Borough Sessions, a few days ago, Alexander Scott, foreman stoker, sued the Kidderminster Gas Company for the non-payment of £1 18s. for a week's wages in lieu of notice; and the Company summoned Scott for breach of contract. In support of the first summons, it was stated that Scott was sent home by the Manager (Mr. A. Dougall) for misconduct about 11.45 p.m. on the 17th ult.; and that though he wrote a letter saying he was ashamed of himself, and asking to be given another chance for the sake of his wife and family, he subsequently said he expected a week's wages or a week's notice. In cross-examination, Scott admitted that on the night in question he had the entire charge of the gas-works, and was under the influence of drink. In support of the Gas Company's summons, Isaiah Hollerton, engine driver, said he heard two men quarrelling in the retort-house. Scott was not on the works, and he sent into the town for him, as there was no one in charge. Witness also sent for the yard foreman, as six men were idle for two hours. George Cartwright, yard foreman, said he was sent for to the works about ten o'clock, and found that a "draw" had been omitted since eight o'clock. He re-started the men, and Scott returned to the works shortly after eleven. He was then under the influence of drink, and witness persuaded him to go home. Mr. A. Dougall, the Manager, said Scott had no right to leave during the night, as he was responsible for the whole of the works. In his absence there was a deficiency in the make of gas to the extent of 36,000 cubic feet. When Scott returned, he was altogether unfit to superintend the works. Mr. Thursfield, on behalf of the Company, submitted that Mr. Dougall was justified in discharging the man without notice. The Bench said the case against the Company would be dismissed. Mr. Thursfield said under these circumstances he would, with the consent of the Bench, withdraw the summons against Scott; and he did not ask for any costs.

Stealing from Slot Meters at the East End.

At the Old Street Police Court on Friday, Alfred Lawson, a tailors, presser, with no fixed abode, was charged on remand with stealing money from gas-meters belonging to the Commercial Gas Company. Mr. G. H. Young prosecuted; and his statement and the evidence adduced showed that the prisoner was in the habit of going to tenement houses in the neighbourhood of Mile End, and representing that he was sent to examine the gas-meter. He invariably chose a time when only women were about, and was unsuspectingly shown the meter, which he at once proceeded to open and otherwise tamper with. On the 27th of August, he called upon a Mrs. Simons, at No. 91, New Road, and stole 5s. 8d. from the money-box of the slot meter. On the 30th, he did the same at the tenement of a Mrs. Davis, No. 48, Spital Street, Mile End, and got 3s. 4d. Later on the same day he presented himself to Mrs. Fishman, at No. 12, Pelham Street, and at his request was shown the meter, which he opened. Mrs. Fishman, however, appeared to entertain some suspicion, and did not leave him. Presently he remarked that the meter drawer was broken, and he would have to go and get tools to mend it. She remarked that he ought to have his bag if he came from the Gas Company. He said his mate had it next door; and he tried to leave, at the same time offering her 1d. As he went down the stairs, she called to a neighbour; and this led to the prisoner being stopped. He then took 1s. 10d. in coppers from his pocket, and begged to be allowed to go. He pleaded guilty; and Mr. Biron sentenced him to six months' hard labour.

The Wolstanton Gas Arbitration.—At the meeting of the Gas Committee of the Wolstanton Urban District Council last Tuesday, the Clerk reported that he had taken up the award of the Umpire (Mr. A. J. Ram, K.C.) in the arbitration with the Burslem Corporation—see *ante*, p. 454. The award, it may be remembered, was made in the form of a special case, which will come before the Courts after the Long Vacation. The Clerk reported that the Newcastle (Staffs.) Corporation had declined to accept the offer of the Wolstanton Council for the purchase of their mains, pipes, and fittings, and had given notice of the appointment of Mr. W. A. Valon as their Arbitrator.

Gosport Water Company.—At the half-yearly meeting of the Gosport Water Company last Wednesday, it was reported that the revenue for the six months ending June 30 had been £4305, compared with £4387 in the corresponding period of the previous year. The sum of £2362 was carried to the profit and loss account, bringing it up to £7049. Dividends of 3½, 4½, and 5 per cent. on the various descriptions of stock were declared. It was stated that the contracts for the covered service reservoir at Shedfield and for the duplication of the pumping machinery at Soberton were approaching completion, and it was hoped that during the present year the plant would be in full working order. Since March, the district had been partially supplied from the new source, and the water had been found to be of the purest character.

Indisposition of Mr. Timmins, of Wigan.—When moving the confirmation of the Gas Committee's minutes at the last meeting of the Wigan Town Council, Alderman Holmes said the great advance in the price of coal (on an average 2s. 6d. per ton) meant an increased cost to the town over last year of £5000. It looked very serious, especially when they had contracted for one of their residuals, tar, some three months ago, at last year's price. The hopeful points were, first, the increased amount of gas consumed by the public, which up to the present time, from April 1, was over 7 million cubic feet; and, secondly, the price of coke must of necessity follow that of coal. Their Engineer, Mr. J. Timmins, he regretted to say, was somewhat out of health; and the doctor insisted that he must leave his work, and go for a change of air, which would doubtless improve him. The Gas Committee, in their wisdom, thought fit to grant Mr. Timmins an additional holiday; and he was pleased to be able to say that he was now gradually, but slowly, improving in health.

MISCELLANEOUS NEWS.

SHEFFIELD UNITED GASLIGHT COMPANY.

Increased Revenue—Export Coal Tax Question.

The One-Hundred-and-Fifth Ordinary General Meeting of this Company was held last Tuesday—under the presidency of Mr. Wilson Mappin, J.P., the Deputy-Chairman.

The Chairman, in moving the adoption of the report and balance-sheet (which were noticed in the "Journal" for the 20th ult., p. 524), commented on the increased sale of gas during the past half year, which amounted to 9·33 per cent. He said he thought they could regard this as extremely satisfactory, seeing that it came on the top of an increase of 7·21 per cent. in the corresponding six months of 1906. This extension in the use of gas showed that the public of Sheffield appreciated the very low price at which the Company were able to supply it; and it was not surprising that this was so, when they considered that an incandescent gas-burner giving a light of from 50 to 60 candles could be used for sixteen hours for 1d. When this was compared with the ordinary electric bulb, which only gave from 12 to 16 candles illumination for four hours for 1d., it would be seen that gas had nothing to fear from competition in this direction—more especially as the light emitted from an incandescent gas-burner was particularly agreeable to read by, and was far less trying to the eyesight than an electric bulb. The quality of the gas supplied had been fully maintained. The average of 1135 tests made during the half year by the Company's officials and the Corporation gas-tester had been 17·4 candles. The total quantity of gas sold was 1,567,285,000 cubic feet; and to produce this 154,871 tons of coal were carbonized—an increase of 10,094 tons over the corresponding period of last year. The extra cost of coal had been £6677. The stokers' wages were also more by £1508; and repairing and re-fixing meters cost more by £484. Repairs of works were £4048 less. This was partly accounted for by the sale of old materials, for which they had received £2293, which was credited to this account; the Company having taken advantage of the high prices which had been obtainable for old iron, &c. Repairs of mains and services had been £637 less, and rates £313 less, due to the district rate having been 2s. in the pound, instead of 2s. 2d. On the other side of the account, the revenue from gas, though the price had been 1d. per 1000 cubic feet less, showed an increase, due to the extra consumption, of £2669. Meter-rents and stove-hire were more by £427, coke by £5523, sulphate of ammonia by £762, and earnings of the Company's railway waggons by £114. Tar had yielded less by £217. Forty additional gas-engines had been fixed during the half year, varying in size from ½ to 500 H.P.; their total horse power being 1536½. The quantity of gas used by engines during the past twelve months had been 293,775,800 cubic feet, an increase of 38,963,000 cubic feet, or 15·3 per cent. This indicated that the Company's business in this direction also was progressing favourably. Also 560 gas-fires, 904 heating and other stoves, and 8044 incandescent burners had been sold during the six months, and 222 additional cooking-stoves were let on hire. They would notice that the sum of £5019 had been written off reserve fund investments, to allow for the depreciation in their value. In taking this step, the Directors were following the example of all the large banks and some of the principal gas undertakings in the kingdom. The matter was carefully considered by the Board; and after consultation with the Auditor, the Directors decided that, having regard to the general depreciation which had taken place during the past few years in all high-class securities, and the fact that there did not appear to be any immediate prospect of their recovering, it was the right course to adopt. The net result of the half-year's working was that, after paying the dividend, there would be £2440 to add to the balance carried forward, which would then be £98,234. It was considered by some people to be rather a bold action on the part of the Company to reduce the price of gas from the commencement of last April, having regard to the rising prices of coal and other materials; but the Directors felt they might safely take this step, as they had in the balance referred to a sufficient guarantee that they would be able to maintain this price, at all events during the next twelve months, after which it was possible there would be a reduction on the high prices now ruling, as past experience showed that these trade booms did not last for more than a year or two. They would have seen numerous statements giving reasons for coal being so dear at the present time. He only hoped that the high price of house coal would cause the public to reflect as to whether the Government were acting wisely in allowing such large quantities of all descriptions to be exported without the payment of duty. Cheap fuel was of vital importance to the manufacturers of this country; and the enormous exportation was undoubtedly the cause of the large advance in prices. The duty, besides having a tendency to check the outflow of coal, would have provided the Chancellor of the Exchequer with the nucleus of a fund for old-age pensions, which he had so much difficulty in procuring. Incandescent gas seemed to be more and more favoured by local authorities for street lighting. The latest example was a report by a Special Committee appointed by the Islington Borough Council (who were themselves suppliers of the electric current) to consider a scheme for replacing gas by electricity in 7 miles of streets. In their report against the proposal, the Committee said that the streets affected by the scheme were well lit by incandescent gas, and no case had been made out for the use of a more expensive illuminant, and that the adoption of the scheme would prevent the possibility in the future of any appreciable reduction in the lighting rate, which it was admitted had been excessive. The Committee were therefore of opinion that the scheme should not be further proceeded with. If this was the case at Islington, the conclusion arrived at would apply with much greater force to Sheffield, where the price of gas was less than half that charged at Islington. There was a special matter to which he desired to direct the attention of the shareholders. There had recently been attempts made to float some new Gas Companies; and Syndicates in London had written to Solicitors and others residing in Sheffield to apply to this Company for a list of their shareholders, in order that they might send prospectuses to them. The plan of the promoters of

these new Companies was to buy for a small sum a gas-works in some out-of-the-way village, re-christen it, and then endeavour to sell it to the public at an amount many times its value. Such over-capitalized concerns could not pay; and it was to be hoped that if any of their shareholders received prospectuses, they would speedily consign them to the waste-paper basket. So far these people had not succeeded in obtaining the addresses of the shareholders, as the gentleman through whom the application had been made had, after an interview with the General Manager (Mr. Hanbury Thomas), declined to render them any assistance. He had, however, considered it his duty to mention the subject, in order that the Company's shareholders at all events might be on their guard, and not be deluded by visions of dividends which could not possibly be earned.

Mr. H. K. STEPHENSON seconded the motion, which was carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. B. G. WOOD, the usual dividends were declared.

Mr. RICHARDSON moved the re-election of Sir Frederick Thorpe Mappin as a Director of the Company, and expressed his regret that Sir Frederick was unable to be present at the meeting. Mr. MIDDLETON seconded; and the resolution received the hearty assent of the shareholders. Mr. T. H. Waterhouse and Mr. J. D. Webster were also re-elected Directors.

A vote of thanks to the Chairman, Directors, and officials of the Company concluded the business.

AUSTRALIAN GASLIGHT COMPANY.

Seventy Years' Progress.

The Annual Meeting of this Company was held at the Royal Exchange, Sydney (N.S.W.), on Monday, the 29th of July—Mr. G. J. Cohen, the Chairman of the Company, presiding.

The SECRETARY (Mr. R. J. Lukey) having read the advertisement convening the meeting, the report of the Directors was taken as read. They stated therein that the profits for the six months ending the 30th of June amounted, with the balance brought forward, to £67,433; and they recommended the payment of a dividend for the half year of 9s. each on the old shares, and in proportion on the new shares, free of income-tax. This would absorb £60,000, and leave £7433 to be carried forward. The Engineer (Mr. T. J. Bush, M.Inst.C.E.) reported that the whole of the plant was in excellent condition; but, in consequence of the increased consumption of gas, the Directors had decided to complete the second retort-house at the Mortlake station, which would involve an expenditure of about £25,000.

The CHAIRMAN, in moving the adoption of the report, expressed his pleasure in stating that the consumption of gas during the period covered by it had exceeded that of any previous six months; but, unfortunately for the Company, the same might be said with regard to the expenditure. This was owing principally to the increased price of coal, and to the necessity for using some which had not been so satisfactory in its results as had been anticipated. At the beginning of the month [July], however, the use of coal from the northern collieries—a three years' contract having been entered into for its supply at the prices current with the "Vend"—was resumed. It might be interesting to know that the advance in the cost of coal was almost universal; and consequently the Company were not alone in having to report additional expenses in the carbonizing department. The consumption of gas during the half year exceeded 976 million cubic feet—an increase of nearly 81 millions, or upwards of 9 per cent., on the corresponding period of 1906. This increase, he was glad to say, was not only being maintained, but was likely to still further expand in the future; and therefore the Directors had decided to complete the extension of No. 2 retort-house at Mortlake, involving an outlay of £25,000, to meet the contemplated demand for gas. The machinery and other material necessary for carrying out the work had been ordered; and it was hoped everything would be ready and in working order by next winter. In this connection, it was gratifying to notice that the extension of the Company's business was very general in both the city and the suburbs. The newer suburbs, particularly those on the North Shore line, commanded a great deal of the Board's attention, in consequence of the developments going on. The Ku-ring-gai Shire Council, who control the greater portion of the district covered by the Company's mains on that side of the harbour, had undertaken the public lighting of most of the suburbs between Roseville and Wahroonga; and the President of the Council hoped the remainder would be lighted by the end of May next. The extension of the public lighting to these suburbs would undoubtedly add to the attractiveness of the neighbourhood, and be of great benefit to all concerned. His attention had been drawn to the desire expressed by some of the Municipal Councils in the eastern suburbs for the lighting of the Domain and Centennial Park, in which he concurred; but he certainly thought the Government should afford the Gas Company as well as the City Council an opportunity of tendering for it. A short time ago the Company were asked to submit a scheme for the lighting of these parks, based on ordinary incandescent gas-burners, and they did so. But nothing came of it—he understood from want of funds. Now that the matter was again before the public, and the City Council had been named in connection with the electric lighting of the parks, he hoped the Government would not be one-sided in their action, but afford the Company an opportunity of submitting a tender in connection with the high-pressure system of incandescent gas lighting, which had been adopted with the utmost success in the new streets of London and other parts of the Metropolis, as well as in other large cities and towns in England and elsewhere. He had recently seen a series of photographs taken of the sections of the Dublin Exhibition and grounds allotted to high-power gas lighting, and the effects to him were simply marvellous. As he examined the pictures he could scarcely believe such effective artificial lighting could be produced. What could be done at home could be accomplished in Sydney, if the Company were given the opportunity and sufficient financial inducement was forthcoming. Notwithstanding the various attempts to relegate gas to the background, the industry was as buoyant as ever, and maintaining the lead in the great artificial light competition of to-day. He need not again go over the ground he traversed in his last address respecting the great strides gas was making in the capital of England, as well as in other large cities and towns in the British Empire and on the Continent of Europe, except to say that the expansion continued, even to a far greater degree. Those who, for interested motives, failed to observe the signs of the times in this direction, must ultimately find out the weakness of their position. He was very pleased to receive, a few days previously, a letter from an old Australian friend who was now on a visit to the Continent and England for the first time. Knowing the interest he (the Chairman) took in all matters relating to gas, he wrote to this effect.

At Marseilles, Nice, and in Paris, and also in London, gas is more than holding its own. Outside all large hotels, places of amusement, and city centres where electric light is used up to midnight, the hulk of the lighting appears to be gas. On the Champs Elysées, the Boulevards, and other beautiful places in Paris, the lighting is all by gas. All the places of amusement and refreshment in these grounds are brilliantly illuminated by gas. It is evident that with the cheaper illuminant they are able to be lavish in its use, and to carry the gas among the trees; thus preventing the shadows that are inevitable with the electric light. In several places in London—taverns especially—the electric light has given place to a scheme of illumination by gas taking the form of very large lamps glazed with heavy glass with stars and other devices embossed thereon; the four burners inside each lamp producing a most brilliant effect.

In the earlier part of the year, London celebrated the centenary of gas lighting in that city. They were told that just a hundred years ago (Jan. 28, 1807) vast crowds assembled in Pall Mall to gaze at a row of gas-lamps in front of the colonnade before Carlton House, in honour of the birthday of King George III. What a contrast to the public and private gas lighting of the City to-day! He was reminded that the Australian Gaslight Company had now passed its 70th birthday; and few companies could boast of so interesting a history as theirs. The "Sketch" published by the Secretary on the occasion of the Company's Diamond Jubilee in 1897 was full of interesting reminiscences.* The growth of the Company had been most remarkable; and the shareholders and consumers alike had shared its success. At the commencement of the Company's career, the charge for gas was at so much per light; but afterwards, when meters were introduced, the rate was 25s. per 1000 cubic feet, and public lamps cost £10 a year. To-day the price to ordinary consumers was 4s. per 1000 cubic feet, and the charge for the public lamps was £4 per annum. The Company's present rates compared very favourably with those of English gas companies, when the extra cost of labour and the additional charges, with heavy duties, attaching to the importation of most of the necessary material and plant from abroad in connection with the manufacture of gas, were taken into account. The Company had now laid 2166 miles of mains and service pipes; the consumers numbered 77,161 (an increase of 2465 during the past half year); and there were 10,540 public lamps. The applications for penny-in-the-slot meters showed no sign of abatement; the number of houses at present fitted up exceeding 25,000. It was interesting to note that many of their customers had of late been purchasing the Company's fittings, and had thus become ordinary consumers. In some instances they had put in additional lights and also gas-cookers, and thereby very materially augmented the consumption of gas. The number of gas-cookers sold by the Company to date was 15,176; being an increase of 564 during the half year. The proprietors would readily imagine that the staff must necessarily be a large one. Including officers, clerks, and workmen, it numbered at present 370. The advance of the Company during the past seventy years had been marvellous; and he could see nothing at present that was in any way likely to mar its progress in the future.

The DEPUTY-CHAIRMAN (Mr. J. H. Storey) seconded the motion, and it was carried unanimously.

The retiring Directors and Auditors were then re-elected; and the proceedings closed with a hearty vote of thanks to the Directors for their services during the half year.

MELBOURNE METROPOLITAN GAS COMPANY.

The Half-Yearly General Meeting of this Company was held in the Offices, Flinders Street, Melbourne, on the 27th of July—Mr. JOHN GRICE, the Chairman of the Company, presiding.

The SECRETARY (Mr. John Hinde) read the notice convening the meeting, and the report of the Directors, which was accompanied by the accounts for the six months ending the 30th of June, was taken as read. It showed that the net profits for the half year, including a balance of £2449 brought forward, amounted to £63,163, from which the Directors had transferred £12,500 to the reserve fund account, and £2500 each to the meter renewal fund and gas-stoves, &c., account; and they recommended the payment of a dividend at the rate of 5s. per share, amounting to £42,860, which would leave £2803 to be carried forward.

The CHAIRMAN, in moving the adoption of the report and accounts, said they showed that the Company maintained a satisfactory position, and gave evidence of an increase of business on sound lines. On the credit side of the profit and loss account, it would be seen that the total receipts amounted to £208,965, against £187,473 for the corresponding period of last year—an addition of £21,492, of which £14,828 was due to sales of gas by meter; the balance representing all-round increases in the results from sales of residuals. The total quantity of gas sold for the half year showed the very substantial advance of nearly 10 per cent. over the figure for the like period of 1906. In his remarks at the half-yearly meeting in July last year, he said the Directors anticipated that in another twelve months they would be able to show a very considerable increase in consumption through slot meters; and this anticipation had been fully realized. At that time 3027 of these meters had

* The "Sketch" referred to was noticed in the "JOURNAL" at the time of its publication (see Vol. LXXI., p. 1125).

been installed in three of the Company's districts. During the intervening period, the system had been extended to two others (Port Melbourne and Richmond); and the number of these meters fixed on the 30th of June last was 6509—the quantity of gas consumed by slot meters during the half year just completed being a little over 27 million cubic feet, against about 11¾ millions in the June half of 1906. There was no falling off in the demand for these installations. On the debit side of the profit and loss account there were one or two items calling for remark. The cost of coal was £6022 more; but this was mainly due to the greater tonnage purchased to meet the demands of the additional business done, though the higher price under the new contract accounted for some portion of it. In reference to this matter, the shareholders were informed twelve months ago that tenders had been invited for the Company's requirements dating from the expiration of the contract on the 31st of March last, and that for certain reasons no tenders had been received. He was now able to report that a contract had been signed for three years from the 1st of April; the extra cost to the Company, on the present basis of consumption, being about £6000 per annum. The amount of wages at the works was larger, owing to additional business, and also to the increased rate of pay granted to stokers and others in the early part of the present year. By far the most important figure, however, on this side of the account was that under the heading of "Repairs and maintenance of works," which showed an increase of £5703 over the June half of 1906. With respect to this item, it was necessary to point out that a considerable amount of money was being spent on schemes of reconstruction at two of the works, rendered necessary by the largely increased demand for gas, and also by reason of the plant becoming obsolete and worn out. At the West Melbourne works, the reconstruction of No. 2 retort-house was nearing completion; and when finished it would have cost about £15,000. The retort-house had been built on up-to-date lines—regenerative furnaces being installed throughout; and the reconstruction had been designed with the object of making the operations as automatic as possible. The old stoking machinery, which was now worn out, had been abandoned, and one of the latest types—the De Brouwer—installed; and whereas under the old system two charging and two drawing machines were required to fill and empty the retorts, with the new system two machines would do the whole of the work. The motive power for these machines would be electricity, for which generators driven by gas-engines were being put down. At the South Melbourne works, more extensive reconstruction was needed, in order to bring the retort-house up to the present-day standard, and to meet the increased output of gas from these works. This had lately been exceptionally heavy, partly owing, no doubt, to the large number of slot-meter installations in the Company's southern district. The first portion of the scheme comprised the reconstruction of the northern half of the retort-house, and involved a general re-arrangement, so as to provide increased accommodation for the storage of coal—a very necessary provision. The retort-settings at these works were at present direct-fired; but the Directors had decided to instal the regenerative system, and all the new settings (20 in number) would be heated by this more economical method. It was intended also to equip the retort-house with the latest form of stoking machinery, in order that the manufacture might be conducted as economically as possible; and it was necessary, in order to carry out this reconstruction, and to provide room for the modern plant, to raise the roof of the retort-house. It would thus be seen that there was a considerable amount of work ahead, which it was anticipated would occupy the greater portion of the next twelve months. When completed, the reconstruction of the northern half of the retort-house at South Melbourne would have cost the Company some £32,000. The southern half, the reconstruction of which would follow in the immediate future, if the output of the Company continued as was expected, was estimated to cost some £13,500 extra; making a total expenditure at South Melbourne of £45,500. With the new plant, they anticipated being able to obtain an increased quantity of residuals for sale, and also to manufacture gas considerably cheaper than was being done at present. One item, though small in amount, was well worthy of passing reference, as evidencing the care exercised by the officials of the Company—viz., "Bad and doubtful debts," which showed a reduction, notwithstanding an increase of over £20,000 in revenue; the bad debts representing only ¼ per cent. of the revenue. The rest of the figures were normal; and the balance carried to the net revenue account was £6573 more than last June. In order to meet expenditure out of the reserve fund for the half year, it had been found necessary to effect a transfer from net revenue of £12,500; and £2500 had been passed to the meter renewal fund, to replace withdrawals, and the gas-stoves, &c., account had been credited with £2500 for depreciation. After making these transfers, and providing for a dividend at the usual rate, £2803 remained to be carried forward. The business of the stoves and fittings department continued to exhibit satisfactory results; and the constantly increasing sales—which were very marked indeed in gas-irons, boiling-burners, the issue of stoves on hire and by sale—had no doubt contributed in a very substantial manner to the additional quantity of gas passing through the meters. It was gratifying to know that the Directors' efforts to maintain the position of the gas industry in Melbourne in the face of keen competition, were meeting with the approval of the public. They had quite recently had an instance of this in the case of the New Bijou Theatre, where a complete installation of incandescent gas lighting had been put in the building, and had proved most successful; for though the electric light was also installed, gas was used in preference. Those who had seen the theatre thus lighted preferred the gas as being a better and a softer light. The system adopted, to which attention had been drawn in the Press, was unique in its way, and was suitable for use in similar large buildings. It was important that it should be widely known that the decided advantage electricity alone previously held (of immediately switching on and off) had been rendered applicable, with gratifying results, to gas lighting. Attention had been drawn, on more occasions than one, to the large proportion of complaints, due entirely to faulty gas-fittings, calling for attention at the hands of the staff. As the proprietors were aware, the Company had no authority to interfere with the internal fitting up of houses, and it often happened that the pipes put in were much too small to carry the number of burners they were expected to serve. Frequently the supply to both bath-heaters and gas-fires was taken from pipes which, even in the first instance, were barely sufficient to maintain a proper supply to the burners; the consequence being that the heaters and fires were never adequately served, and when they were in use the result was an immediate falling off in the illuminating effect produced by the lights. Failing legislation dealing with this subject, much could be accomplished if the Gas Company were consulted before the sizes and the positions of pipes were decided upon for new buildings. In this connection, he might say that a step in the right direction had been taken by several prominent firms of architects in Melbourne, who had asked the Directors to co-operate with them in determining the most suitable method of installing new premises. He mentioned this matter now because he was convinced that the adoption of such a course generally would bring about greater mutual satisfaction to the consumer, the architect, and the Company. Since the last meeting the High Court of Australia had given their decision, after protracted litigation, declaring the Welsbach patent invalid. To the gas consumers in Victoria the result was not of the same moment as it would have been some years ago, inasmuch as the current prices for mantles had been greatly reduced; and, in any case, the patent would have expired by effluxion of time on March 31, 1908. During the previous few days, the Judicial Committee of the Privy Council had heard the appeal of the Company against the decision of the High Court of Australia with respect to the adoption by the City Council of Melbourne of the "maximum demand" system of charging for a supply of electricity as an alternative to the flat-rate. The members of the Privy Council had reserved their decision. In the meantime, it might be assumed, from the attitude of that body, that the points raised involved serious consideration.*

The Hon. THOS. LUXTON, M.L.C., in seconding the motion, said the Chairman had put the position of the Company so clearly before the meeting as to leave very little room for criticism. He was delighted to know that the slot-meter system was paying so well. When the subject was referred to twelve months ago, some of the shareholders thought the adoption of the system involved a certain amount of risk; but it was now evident that the Directors had acted wisely in the matter, as shown by the results to date. The number of these meters installed was increasing day by day; and he felt assured that the quantity of gas consumed through them would be a source of great revenue to the Company in the future. It was gratifying to the shareholders to know that during the past six months the profits had exceeded by £6573 those of the corresponding period of last year; and as time went on he thought the position would still further improve. The Company had undoubtedly very bright prospects. A word of praise was due to the officials for keeping the bad debts at so low a figure as ¼ per cent. of the total revenue, which was sufficient evidence of the careful manner in which the business was being conducted.

The motion was carried unanimously, and the dividend recommended was declared.

A vote of thanks was accorded to the Chairman, who, in acknowledgment, remarked that his office was rendered comparatively easy by reason of the prosperity of the Company, which was in part—in fact, he would say to a very great extent—due to the officials. This applied not only to the Secretary and the Engineer (Mr. P. C. Holmes Hunt), but to the heads of the various departments, who were most enthusiastic in their work; and he did not think a better body of men could be found.

The meeting then terminated.

* The decision of the Privy Council was noticed in the "JOURNAL" for the 20th ult. (p. 519).

COLONIAL GAS UNDERTAKINGS.

Reports on the working of several Colonial gas undertakings have lately come to hand, and the following particulars are extracted from them:—

In the half year ending the 30th of June, the sale of gas, &c., by the Brisbane Gas Company produced a revenue of £22,686; and the balance at the credit of the profit and loss account, with the amount brought forward, was £12,772. The Directors recommended a dividend of 5 per cent., which amounted to £8000, and income-tax came to £400. This left £4372 to be carried forward. In the six months covered by the report, the Company's mains were extended into various suburbs.

The Maryborough (Queensland) Gas Company, Limited, had in the half year ending June 30 a revenue of £2885 from the sale of gas, fittings, &c., and £159 from the sale of residual products. These two sums, with the balance brought forward (£1058), made a total of £4102. The manufacturing and other charges and the dividend for the six months ending Dec. 31, 1906, came to £3033; leaving a balance of £1069. The Directors recommended the payment of a dividend at the rate of 6 per cent. per annum (free of income-tax), amounting to £771; leaving £298 to be carried forward.

At the recent meeting of the City of Newcastle Gas Company, Limited, the Directors presented their 82nd half-yearly report and balance-sheet. They showed that the profits, after meeting all charges, amounted, with the sum brought forward, to £4582. From this the Directors recommended the payment of the usual dividend of 3s. per share, free of income-tax, which would absorb £3375, and leave £1207 to be carried forward. The sales of both gas and residuals were satisfactory during the half year.

The North Shore (Sydney) Gas Company, Limited, had a net profit, after allowing for reserve and depreciation, of £5997, in the six months ending the 30th of June. Adding the amount brought forward, a sum of £6060 was produced, out of which the Directors recommended a dividend of 4 per cent. for the half year, the payment of which would absorb £5999.

The Horley and District Gas Company have placed an order with Messrs. R. Dempster and Sons, of Elland, for a new retort-bench on Waddell's system, in accordance with detail plans and specifications prepared by the Company's Engineer, Mr. R. Seymour Tobey.

SHREWSBURY GAS COMPANY.

The 87th annual report of the Directors of the Shrewsbury Gas Company, which was submitted at the meeting on Monday of last week, stated that the profit on the working for the year ending June 30 amounted to £8512. An interim dividend of 2½ per cent. was paid last March; and the Directors recommended the declaration of a final dividend of 3 per cent. (making 5½ per cent. for the year), which would leave a balance of £2304 in the profit and loss account. The reserve fund amounted to £10,387, and was fully invested. There was an increase of 4 million cubic feet in the consumption of gas during the year. The stoves on hire at June 30 numbered 2563; and there were 3130 slot-meters in use. There was a large increase in the cost of coal for the ensuing year; but it was not the intention of the Directors to make any change in the price of gas. The Board expressed deep regret at the loss of their colleague Dr. E. Calvert, who died in May last, after 28½ years' useful and valuable service as a Director.

Mr. T. F. Poole, who presided, said the Chairman (Mr. J. Spencer Phillips) was sorry not to be able to be with them; but he had forwarded some remarks on the Company's affairs. In the course of these, after referring to the loss sustained by the death of Dr. Calvert, he pointed to the very satisfactory character of the report. He said that during the year they had made 3,477,500 cubic feet more gas, or 1·798 per cent.; and they had sold 3,993,927 cubic feet more, or 2·28 per cent. But notwithstanding this increase of gas made and sold, there was a decrease of 211 tons, or 1·164 per cent. in the coal used in the manufacture of it. This was partly owing to the saving which the new plant effected, and partly to the care of the management in leaving no stone unturned to promote economy combined with efficiency. The unaccounted-for gas had fallen from 5·92 to 5·69 per cent., and had now arrived very nearly at the point at which it stood before the mains were so seriously damaged by the sewerage operations which were carried out some ten years ago. No endeavour would be wanting to reduce the figures if possible to a still lower ratio. The Company had had a good deal of trouble in their past history with naphthalene—a substance which, in spite of every care in the manufacture, still found its way at certain times (more particularly in the hot weather) into the mains, causing annoyance to the customers, and considerable expense to the Company in removing it. Three or four ways had been discovered for dealing with the difficulty; and finally, after having inspected the various apparatus, the Board decided upon installing the Colson system. They were very pleased to state that up to date they had found it most efficacious, as instead of having numerous complaints, they had not so far had a single one. They intended during the coming winter to adapt it to the old works, as at present it had only been installed in the new ones. Out of the past year's income, the Board had paid for the alteration of the offices—an outlay which had proved of great convenience to the customers and the staff. The year's revenue had also been charged with the expense of the valuation for the rating of the works, an expenditure which had been thoroughly justified by the result of the assessment, increased though it unfortunately was. They had also painted the whole of the works—an expense which was generally spread over two years. Notwithstanding these rather abnormal drains, they were able to pay the same dividend as last year, and to increase the carry-forward from £1804 to £2304—an addition of £500. The outlook for the coming year was not quite so hopeful, owing to the great rise in the price of coal. This increase hit equally hard every gas and railway company in the kingdom, as well as most large manufactories. But in spite of the large increased expenditure they had to face on this head, the Board had not thought it necessary on this occasion to raise the price of gas; and they believed there was no doubt of their being able to maintain the dividend—a result which would commend itself to the shareholders as showing what had been done to manage their affairs with caution and prudence. It was, perhaps, unnecessary to add that everything had been done to keep the works and plant up to the highest possible state of efficiency, a matter to which the Manager, Mr. W. Belton, gave his closest attention—as indeed he did to the whole welfare of the Company. This certainly never would be neglected as long as the shareholders entrusted the present Board with the management of their affairs. The proper upkeep of plant and machinery was of most vital importance in any trading or manufacturing concern.

The report was adopted, the dividend recommended was declared, and the Chairman and Directors and Mr. Belton and the other officers were thanked for their services.

HARROW AND STANMORE GAS COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held on Monday of last week, at the Holborn Restaurant, W.C.—Mr. A. H. Baynes in the chair.

The Secretary and Engineer (Mr. J. L. Chapman) read the notice convening the meeting; and the Directors' report and accounts were taken as read. The report stated that, following the reduction in the price of gas, there had been a satisfactory increase in the consumption during the past half year, as compared with the corresponding period of 1906; and notwithstanding the great advance in the cost of coal, the Board had no intention of increasing the price of gas. The Directors had, under the compulsory powers of their Act, arranged to purchase a further 3 acres of land; and the Engineer was now enlarging the new retort-house upon the ground where the last portion of the old works ately stood, to meet the continuously increasing demands upon the Company. The balance of profit and loss account was £7971.

The Chairman, in moving the adoption of the report and accounts, remarked that when last he had the pleasure of meeting the shareholders, he congratulated them on having had presented to them the best report that had ever been distributed by the Directors of the Company; and he thought he might that day congratulate them on the fact that the report in their hands (for the six months to June 30) showed continued progress. If they compared the results of the last half year with those of the corresponding period of 1906, in the few figures he was going to give they would agree that he was not wrong in stating that considerable advance had been effected. The gas-rental for the half year just closed amounted to £12,971, an increase on the first half of the preceding year of £916—and this notwithstanding the fact that the price of gas for the March quarter was 3d. per 1000 cubic feet lower in the inner area and 4d. in the outer area, and that for the June quarter the charge was lower by 2d. throughout the entire district. He thought that the consumers had been very well treated indeed in respect of these continuous reductions. Had it not been for the lowering of the price, the increase in the rental would have amounted to £1737. The coke and residual accounts showed an increase of £556. The receipts from tar were £92 more; and the total receipts for the half year came to £16,810, which was an increase of £1681 on the first half of 1906. The total expenditure for the first six months was £11,393, which was an increase of £1234. It could not, however, be but satisfactory to know that the cost of the new retort-house had been practically speaking paid for out of revenue. The pulling down of the old retort-house, and cleaning of the bricks had been charged to repairs, the increase under which head was £486. Of coal, 525 tons more were carbonized, which involved an extra cost of £585. Carbonizing wages, as might be expected, were more by £43; and rates and taxes, which seemed to be always increasing, exhibited a rise of £76. A sum of £25 had been added to the workmen's insurance fund; and £200 had been written off prepayment house services, and similar amounts off meters and stoves. The total profit was £5417—an increase of £447. The dividends recommended were as last time, and would amount to £4405, to which had to be added debenture interest and interest on loans £583, leaving a balance to be carried forward of £429. Adding this to the previous balance of £3137, there was a total amount to be carried forward of £3566. The quantity of gas made during the past half year was 73,902,000 cubic feet, of which 51,283,000 cubic feet was coal gas, and 22,619,000 cubic feet carburetted water gas. The quantity of coal carbonized was 4646 tons; the production of gas being 11,038 cubic feet per ton. Of oil, the amount used was 57,155 gallons, the production of gas being 1000 cubic feet per 2·52 gallons. The gas sold was 70,168,000 cubic feet, which was equal to 94·95 per cent. of the total make. The gas used on the works was 1·35 per cent., and the unaccounted-for gas 3·70 per cent., of the make. Compared with the corresponding period of 1906, the consumption of gas during the past half year in the Harrow district showed an increase of 17 per cent., in the Sudbury and Harrow Weald district an increase of 27 per cent., and in Stanmore an increase of 8·13 per cent. He thought the shareholders would regard these figures as indicating very considerable progress in the half year under review; and they ought to congratulate Mr. Chapman upon his management during that period.

Mr. H. J. Rydon seconded the motion.

Mr. J. H. Lea asked whether the Directors thought of making anything like "Coalite" or "Carbo."

Mr. Chapman said the Board had no idea of doing so at present.

The resolution was then carried unanimously.

On the motion of the Chairman, seconded by Mr. A. F. Phillips, dividends were declared for the half year at the rates of 10 per cent. per annum on the original "A" capital, and 7 per cent. per annum on the additional "B" capital, the additional "C" capital, and the guaranteed shares—all less income-tax.

Mr. Phillips, in proposing a vote of thanks to Mr. Chapman and his able assistants for the excellent results they had achieved during the past half year, remarked that, considering the competition with the electric light that had to be met in Harrow, it must be as gratifying to their Engineer as no doubt it was to the shareholders to find that there had been an increased sale of gas in the district of 17 per cent. Not only had Mr. Chapman watched over the development of the consumption, but the figures in the accounts showed that the manufacture and distribution of gas also received his careful attention.

Mr. R. S. Bathe, in seconding, remarked that, speaking as a resident in the district, he was surprised the Company had been able to do as well as they had; and he thought great credit was due to the management.

Mr. Chapman, in returning thanks for the vote, said they had got into a condition of going forward, which did not seem to pass away; for the same increase was going on to-day as was shown in the balance-sheet presented at this meeting. The results achieved were largely due to his assistants and workmen entering into the new conditions. They had all done their best; and he had suggested to the Directors that they should not forget that this was the case. He thought they would arrive at still better results as time went by.

Mr. F. Lennard proposed a vote of thanks to the Chairman and Directors; and Mr. F. R. Smith, in seconding, said he heartily agreed with the policy adopted, of reducing the price of gas and as far as possible charging extensions to revenue account. The latter was a sound policy, and would reduce the capital expenditure of the Company—which was one of the main things to be sought after. The increase in consumption was, to his mind, almost phenomenal.

The Chairman, in reply, said the Board were glad to be able to present such a report; and they felt that congratulations were due to Mr. Chapman, who had devoted himself in a most remarkable manner to the interests of the Company.

Increase in Price at Blyth and Cowpen.—At the recent half-yearly general meeting of the Blyth and Cowpen Gas Company, it was reported that a balance of £3060 had been carried to the profit and loss account; and a dividend of £3 per cent. was declared on the ordinary stock. In the course of his remarks, the Deputy-Chairman (Mr. R. G. Dobson), who presided in the absence of the Chairman, alluded to the inflated state of the coal market; stating that the Directors had entered into a contract for the supply of coal at an increase of 3s. 7½d. per ton, which was an advance of 30 per cent. at least upon the one just concluded; and in consequence the Directors would be reluctantly compelled to give notice to all consumers that after the meter readings this month the price of gas would be increased 2d. per 1000 cubic feet—from 2s. 10d. to 3s.—the discounts to continue as heretofore.

PROVINCIAL GAS COMPANIES.

Reduced Price and Increased Sales at Bath.

At the recent half-yearly meeting of the Bath Gas Company, the Directors reported that there had been an increase of nearly 4 per cent. in the quantity of gas sold in the six months ending the 30th of June, compared with the corresponding period of 1906, which was sufficient to cover the loss in revenue consequent upon the reduction made in the price of gas. There was a good demand for coke; and as the sulphate of ammonia account showed up well, the returns for residuals were very favourable. The statistical statements accompanying the report showed that the revenue from the sale of gas in the half year was £29,861, against £29,815 in the first half of 1906; while the residuals produced £10,272, compared with £8564. The total receipts were £43,979, against £42,011. The expenditure on the manufacture of gas was £23,025, against £23,249, though the raw material (coal and oil) cost more—£16,100, compared with £15,172. The saving was on the repair and maintenance of plant, on which £3949 was spent in the past six months, and £5100 in the corresponding period of last year. Distribution was higher—£5472, against £4679; but management was about the same as before. The total expenditure was £32,701, against £31,824; and the balance carried to the profit and loss account £11,278, compared with £10,187. The amount available for distribution was £11,537; and the Directors recommended the declaration of the maximum dividend of 5 per cent. per annum, less income-tax, on the consolidated ordinary stock. Reference was made in the report to the passing of the Gas Companies (Removal of Sulphur Restrictions) Bill last session, whereby the Company have obtained relief from these restrictions at a moderate cost.

Satisfactory Position of the Falmouth Company.

In spite of some adverse circumstances, the Falmouth Gas Company have had a successful year; and Major Mead, the Chairman, was able, at the annual meeting yesterday week, to congratulate the shareholders on the presentation of the most satisfactory account the Company have had. The report of the Directors referred to the passing of the Bill promoted last session, and recorded the fact that a new building and plant for the manufacture of sulphate of ammonia had been erected. The total receipts amounted to £10,146, of which a sum of £8065 was from ordinary sales of gas, £1556 from coin meters, £394 from rental of meters and stoves, and £1564 from rents of property. Last year's total receipts were £9633; and the balance of profit this year was £2848, compared with £2615 before. An interim dividend of 5 per cent. had been paid, and 1 per cent., the balance of the statutory dividend, carried to the reserve fund. The Chairman said that with extra care the Directors had been able to avoid an increase in the price of gas, and had, indeed, improved the quality. The proprietors must not, however, expect such a satisfactory account next year, for coal had again risen, and they had to face the opposition of the electric light. In addition to putting in new sulphate of ammonia plant they had during the past year passed their Bill through Parliament (with practically no opposition), and bought the property adjoining the works. They were now safe for another twenty years, and need not trouble about any expenditure on parliamentary costs. The output of gas had increased a little; and considering the introduction of the electric light, the Company were not doing badly.

Progress at Hastings.

Dr. G. G. Gray, J.P., the Chairman, presided over the meeting of the Hastings and St. Leonards Gas Company last Thursday; and in moving the adoption of the report and accounts for the half year to June 30, he said there had been an increase in the amount of gas sold, in round figures, of 9½ million cubic feet—equal to 4·32 per cent There was an increase from meters and stoves of £116, from residuals of £2162, and from various small items of £49. The total increase on the half-year's revenue amounted to £2687. With regard to the residuals, coke showed a large increase, due principally to the rise in the price of coal. There had been an increase under the head of tar due to a better price, owing probably to the amount now used for motor traction. On the expenditure side, there was an increase under the head of coal, oil, &c., of £2169, due in part to using more, but mainly to the rise in the price. There had been a total increase of £2827 on the expenditure side, from which certain deductions left a net increase of £2533. There was a net increased profit of £154 on the half year, the profit balance for the half year being £12,005. In spite of competition, fair and unfair, of mis-statements, honest and dishonest, the half-year's consumption of gas showed a real and substantial increase on a sound and businesslike balance-sheet. They did not increase their revenue by supplying to themselves all the gas that they could. They did not pay more for an article when they could get equally good, or even better, results at a lower cost; and objection to such extravagance was all the stronger if official sanction to it had been refused after a public inquiry. Putting money into one pocket by taking it out of the other was no gain, especially if some was lost in the transfer. They did not expend money in putting in new mains where they were not assured of sufficient customers to justify the expenditure. Their local rates on every pound of gross profit made amounted to 2s. 3½d.; and they could not escape the usual rating by paying only 5½d. in the pound. Their income-tax came to £639; they did not omit to debit themselves with it. It was not in this way that they showed an increase or a balance. And they were not afraid of having their accounts criticized; they were pleased to hear any, even if interested in any competing illuminant, knowing that the accounts would bear full investigation. The one unsatisfactory feature was the high price of coal and oil. With their large consumption, an increase of 3s. 4d. per ton—which they had to pay under their present contract, expiring next June—was equivalent to £3000 on the half year, or 2d. per 1000 cubic feet manufactured. This required a good deal of making up. In consequence of this rise, most companies had raised, or had given notice that they would raise, the price of gas 2d., 3d., or even more per 1000 cubic feet. The report and balance-sheet showed that they did not require at present to do so; and the Board hoped that they might not have to during the next half year. But neither did they, in the face of such facts, propose to reduce the price of their manufactured commodity, either by a real or a fictitious concession. If the reduction was only apparent—a juggling with figures—it was illusory and misleading; if it were real, it was unsound finance, and absolutely unjustifiable under existing circumstances. They had not the rates to fall back upon to make up any deficiency; and they could not make people who did not use their illuminant pay for what they did not want. How long would ratepayers suffer in silence, instead of arising, as at Islington, and stopping such burdens on the rates? They heard of a good many new electric lamps, which were to cheapen that method of illumination to compete with gas. They reminded him of Pope's line that "Man never *is*, but always *to be* blest." All new electric lamps the Company tested in order to prove their real illuminating value and cost. They knew, therefore, that it was misleading to speak of the light which could be obtained by one of these lamps, and the cost thereof, when they could only be used in couples, and to over-state the light they gave, and to under-state that of the lamps with which they were compared. They had long been told that "electricity is the light of the future;" and they were content that it should remain so. Gas was still the light of the present. The report was adopted; and the statutory dividends were declared. Moving a vote of thanks to the Directors, officers, and staff, Mr. Oke eulogized the work of Mr. C. E. Botley, M.Inst.C.E., the Engineer and Manager, and others at Glyne Gap. In reply, Mr. Botley said the results were improving every month.

A Good Position at Richmond.

Addressing the shareholders at the half-yearly meeting of the Richmond Gas Company, the Chairman (Mr. T. J. Carless) said that the capital expenditure in the six months to June 30 had amounted to about £700, which had principally been spent in laying new mains and services in the districts east and north of the gas-works, where building operations were being actively carried on, and from whence they expected shortly to reap the benefit in a large consumption of gas. A certain amount had been expended on cooking-stoves, for which there was still a good demand, notwithstanding the fact that they had at the end of the previous half year over 4000 in use. Turning to the revenue account expenditure, the cost of coal was less by nearly £300, as a result of more efficient carbonizing, a matter upon which the Chairman congratulated those responsible for the working. As to the future, the rise that had taken place in the coal market was giving the Directors much anxiety, as they were most wishful not to increase the charge for gas. Competition by other illuminants was much keener than it used to be; and many additional expenses were incurred in obtaining business which some years ago were not thought of. In regard to revenue account receipts, they were pleased to record an increase in the sale of gas which, though not large, showed progress, especially in these times when the incandescent burner had brought about such a decreased consumption for a given candle power. The increase in stove-rents, too, pointed to the larger number in use to which he had previously referred. Residual products had brought in more money. To sum up the revenue account, the balance compared favourably with the corresponding figures (and this was probably more than a good many undertakings were able to show), owing to the Company's judicious purchases of coal two years ago, when markets were anything but booming. The profit and loss account showed a sufficient balance to allow of the statutory dividend, with a slightly increased carry-forward; and he congratulated the shareholders on the result of the half-year's working. The reserve fund was automatically growing; and the insurance fund had been increased to meet the risks under the Workmen's Compensation Act—the Board having decided to pay to the fund an equivalent of the premiums which would otherwise find their way into the coffers of the Insurance Companies. Experience in the past had been favourable to such a plan. The report was adopted, a dividend at the rate of 5¼ per cent. per annum on the ordinary stock was declared, and the services of the Board and of the Engineer and Secretary (Mr. Thomas May) and staff were suitably acknowledged.

Coal and Assessment Questions at Southend.

The Directors of the Southend Gas Company reported, at the half-yearly meeting last Tuesday, that the sale of gas in the six months ending the 30th of June had been 130,574,400 cubic feet; being an increase of 15,211,400 cubic feet, or at the rate of 13·18 per cent. on the sale in the corresponding period of last year. The number of consumers had risen by 843; the total being 10,569, of which 6953 were on the prepayment system. The accounts showed a sum of £8795 available for distribution; and the Directors recommended dividends at the rate of 5¾ per cent. per annum on the original, consolidated, and new ordinary stocks, and 5¾ per cent. per annum on the new ordinary "B" stock, all less income-tax. The payment of these would absorb £6119, and leave £2676 to be carried forward. In moving the adoption of the report and accounts, the Chairman (Mr. C. Frank Woosnam) expressed his pleasure in referring to the increase in the quantity of gas sold during the past half year. There had been 813 new cookers fixed; and the Directors trusted that the great increase which had taken place in the price of coal would bring about an even greater demand for heating and cooking, by which means, and the higher price they hoped to realize for coke, they would be enabled to avoid raising the charge for gas, as many companies had been obliged to do. He did not know that he ought to say much about what the present or any other Government did with regard to coal; but he noticed that upwards of 4 million tons had been sent out of the country last year in excess of the exports in the preceding twelve months. His opinion was that we ought not to let all this coal go out of the country. We had good money back in return; but what did it mean? The rich mine owners and coal workers put up the price of coal; and this affected everybody, but more particularly the large industries. One trade depended upon another. Perhaps the Government would take this into consideration, and put a handsome tax on exported coal. The Directors had made contracts for another year, but at a cost of an extra 2s. 6d. per ton. Passing on to deal with the items in the revenue account, the Chairman pointed out that, under the Company's new assessment, the rates were £379 more than before. He reminded the shareholders that he mentioned at the previous meeting that the

Directors were going to appeal against the assessment. They did so; but he was sorry to say that the Quarter Sessions upheld the Assessment Committee's amended figures—one of the reasons, he understood, against the Company being that they had not appealed on the previous assessment, and therefore it must stand as correct. The Bench made this their datum; so in future, if they could not agree, they must contest every re-assessment. He saw by the "JOURNAL OF GAS LIGHTING" that there was some idea of gas companies promoting a Bill in Parliament for the rating of gas undertakings on a definite, fair, and understandable principle; and he hoped it would come about. The Southend Company's rates at the present time came to nearly £2000 a year, which was half as much again as they should be. With regard to workmen's compensation, the Directors had considered very carefully the effect of the new Act, and had decided that, for the present, it was better for the Company to pay a premium to an Assurance Company than to start a reserve fund for the purpose of meeting any claims. Mr. Lloyd Wise seconded the motion, and it was carried unanimously. The dividends recommended were then declared; and the proceedings closed with a vote of thanks to the Chairman, Directors, and officers of the Company.

Progressing Business at Sunderland.

The annual general meeting of the Sunderland Gas Company was held last Wednesday—Alderman Stansfield Richardson presiding. In their report, the Directors stated that during the year ending the 30th of June, 548 ordinary and 1580 prepayment meters had been fixed. They recommended the declaration of a dividend of 5 per cent. on the original stock and 4½ per cent. on the additional stock, less income-tax. In moving the adoption of the report, the Chairman said the Company's business was progressing year by year, and the stock was well held. They had had a very good year. The output was larger than in any year of their existence; there being a record growth of business of 74 million cubic feet, compared with the year 1905-6. It would interest the shareholders and public to know that prepayment meters showed a further increase; there being now in use 13,402, against 11,522 last year. These meters were a boon to the poor people, and fairly good business for the Company. They had suffered a little through evilly-disposed persons wrecking the meters and stealing the money contained in them; but he thought the punishment inflicted in a recent case was having a deterring effect. After referring to the works of the Company and mentioning the fact that the contract for the reconstruction of the Ayres Quay works had been let, the Chairman said, while the advance in the price of coal was still more marked than last year, he was happy to say the Board had been well advised, and the contracts entered into, as was the case last year, were well below the current value. Mr. T. W. Stewart, in seconding the motion, said the gas industry was to-day in a sounder position than ever it had occupied, notwithstanding the advance in electricity for lighting and motive power. The report was adopted, and the dividends were declared. It was agreed, on the motion of the Chairman, that in future the annual statement of accounts of the Company should be made up to Dec. 31 instead of June 30 in each year, and that the annual general meeting should be held in March instead of in September.

The Goring Site Still Troubles Worthing.

At the half-yearly meeting of the Worthing Gas Company on the 31st ult., it was stated that the past half-year's profit was sufficient not only to pay the standard rates of dividend, but to augment the undivided profit by £1096. The revenue account showed that the sales of gas for the six months were 10 per cent. beyond those in the corresponding period of 1906; and the profit and loss account had a balance of £12,175. Out of this sum the Directors in their report recommended the declaration of dividends at the rates of 10 per cent. per annum on the original stock, and 7 per cent. per annum on the share capital. The report was adopted. An extraordinary general meeting followed, at which the question of raising additional capital was discussed. The Chairman (Mr. H. H. Gardner) said the Company were bound, by contract, to purchase the new site at Goring for the erection of a gasholder in the immediate future; but, as at present advised, the Directors believed it would be some years before the manufacturing plant of the Company would be removed from its present site. He moved a resolution authorizing the raising, by the issue of new ordinary preference shares or stock, of the sum of £7000, and the exercise of the Company's borrowing powers. The resolution was carried, but not without opposition. Mr. Rodoconachi appealed to the Board to give up the Goring site, having visions of continued opposition. As an amendment, Mr. A. F. Somerset wished to have a Committee of Investigation formed to consider whether a site could not be found which would be less detrimental to the interests of Worthing. On being put, however, it was lost.

Manchester Corporation and Income-Tax.—The Finance Committee of the Manchester Corporation have instructed the Town Clerk to appeal against the action of the income-tax authorities in assessing the departments of the Corporation separately for income-tax. The Committee contend that the Corporation should be regarded in its entirety for the purposes of assessment, so that the losses in one department might be set off against the profits in another.

Serious Gas Explosion at Nottingham.—A serious explosion of gas occurred at a house in Corporation Oaks, Nottingham, last Wednesday night. It was in the occupation of Mrs. Woollatt, who, with her family, had just taken up her residence there. It appears that complaint had been made of poor lights in the drawing-room; and a plumber named Hempstead was about to pour some water into the slide of the chandelier when the explosion took place. He was seriously burnt about the face and hands, as were also two girls and a boy (Mrs. Woollatt's children) who were in the room at the time. Medical assistance was procured as promptly as possible, and the injuries were attended to. The fire was quickly extinguished by the Fire Brigade; but considerable damage was done to the house. It is supposed that gas had escaped from a faulty connection with a new meter in the pantry, which is below the drawing-room, and that the accumulated gas was fired by the light that was being used at the chandelier.

THE INCREASED PRICE OF COAL.

Sir George Livesey's Opinions.

In view of the various theories put forward as to the cause of the rise in the price of coal, a representative of the "Globe" had an interview with Sir George Livesey last Wednesday, to learn his opinion in regard to the influences to which the coal trade is subjected. The following is the report given of what transpired.

"There can be little doubt," said Sir George, "that the revival in the iron trade in the winter of 1905-6 started the rise in the price of coal. The foreign demand also began to increase; and this was greatly accentuated on the repeal of the export duty on Nov. 1, 1906. Since that time the foreign demand has gone on increasing."

"Are you prepared," asked the interviewer, "to state definitely that the main cause of the increased cost to the consumer at home is the removal of the 1s. export duty?"

"Well, the main cause is certainly the greatly increased foreign demand; and though I do not say that if the export duty had remained on there would not have been a great increase, I do not think it would have been so large."

"You are, therefore, strongly in favour of the export duty?"

"What I would have liked to see would have been the doubling of the export duty; for if the foreigner wants our coal, I see no reason why he should not pay for it."

"And what about the action of the railway companies in the matter?"

"The railway companies have been called upon to pay an enormously increased price for their coal. They cannot raise their rates; and so instead of carrying 20½ cwt. at the charge fixed for a ton, as heretofore, they are now only carrying 20 cwt. I would do the same, and so would anyone else."

"As a result of this foreign demand, the home consumer is being hard hit," remarked the interviewer.

"That must obviously be the case. As a Free Trader, I do not see why we should not get five millions or more every year from the foreigner, if he must have more of our coal, and thus help the English taxpayer, and by reducing the quantity exported assist every user of coal at home, whether it be a railway company, a gas company, the manufacturer, or the domestic consumer."

"And what about the outlook?"

"So far as I can see, there is no immediate prospect of reduction; and appearances point to still higher prices."

According to a Glasgow telegram last Wednesday, the price of coal in Scotland was raised to the highest level since the boom of 1900. Consumers are in a state of alarm at the prospect of existing rates lasting until the spring. The miners are easily earning 10s. daily; and if the men worked steadily it is estimated the output would be increased by one-fourth, and prices would rule 2s. cheaper. Since the boom began, prices have advanced 6s.—Russian and other Continental buyers paying premiums to get supplies shipped.

Mr. William Lorimer, presiding last Wednesday in Glasgow at a meeting of the shareholders of the Steel Company of Scotland, said no industry in the country could be assured of permanent demand for its output if the cost of production were to be so gravely affected by the existing extravagant price of coal. Dear coal was the black spot in the trade outlook. It was of the gravest importance that the advance should be arrested, particularly as competition was growing in Germany and America.

A Darlington correspondent of the "Financial News" states: "Not more than once during the past forty years has house coal continued at winter prices all through the summer, as has been the case this year. Coal owners and colliery agents of great experience in the county of Durham are of opinion that, owing to the abnormal demand for manufacturing and export coal, the rates for house coal will show another advance next month, as it is even now fully 6d. to 9d. a ton below the price obtainable for coal for export and manufacturing. The extraordinary demand is due to the requirements from Germany in particular, though Russia, Norway, Sweden, and France are all taking more than usual. Should this demand continue through the winter, prices of house coal will assuredly go up still higher—the most modest expectation being a further increase of 2s. by mid-winter; and many believe rates will rise as much as 5s. a ton above present prices."

ABERDEEN CORPORATION GAS SUPPLY.

The Past Year's Working—The Estimates for 1907-8

At the Meeting of the Aberdeen Town Council on Monday last week, Bailie Kemp, the Convener of the Gas Committee, presented the accounts of the Gas Department for the year ending the 31st of July, a summary of which was given in our Scotch Correspondent's "Notes" last week. He said the total income, as shown in the revenue account was given as £112,746, while the expenditure was stated at £92,950. The latter figure was some £913 more than in the preceding year. This was not to be wondered at when one considered that coal alone cost some £3550 more than in the previous year. One-half of this large increase arose from an advance in price; the remainder arising from the greater quantity required. The balance carried to the net revenue account was £19,795, or £790 less than before. They started the year with £9976 in hand, of which they had used £3589; leaving to be carried forward to the next account £6387. This looked at first sight as if they had lost something on the year's working; but, as a matter of fact, it was not so. Out of this amount a sum of £4000 had for the first time been carried to a renewal fund. When this item was taken into account, it would be seen that, notwithstanding the greatly enhanced cost of material, the revenue had more than met the expenditure of the year. The total capital expenditure up to July 31 was £350,093. Loans on mortgages and annuities were down by £13,044; sinking and contingent funds

were up £10,430. The reserve and fire insurance fund was increased by £1528; while, as mentioned, there appeared this year as a renewal fund for the first time, £4000. During the year there had been manufactured 725,301,000 cubic feet of gas; being an increase in round figures of 34 million cubic feet. There were one or two instructive facts which did not appear in the accounts, but which it might interest the Council to know. In 1900 the number of consumers stood at 30,001. On July 31 last they stood at 31,987. In 1900 the number of slot-meter consumers was 2444; but at the close of the year under observation they stood at 7067. In 1900 the number of gas heating and cooking stoves on hire was 1630, and on July 31 they stood at 3572; being an increase of 296 on the previous year, and of 1128 on the number two years ago. From figures like these, and an increase in manufacture of from 20 to 30 million cubic feet per annum, it would not appear as if the days of gas undertakings were numbered. Turning to the estimate for this year, the revenue was anticipated to be £114,528, and the expenditure was put at £122,670. To meet this there was the estimated revenue of £114,528, *plus* £6386 carried forward, which together would leave an estimated deficiency of £1756. The enhanced price of coal represented a sum equal to 3d. per 1000 cubic feet of gas. In the opinion of not a few, the Committee would have been perfectly justified in raising the price of gas to meet the increased cost; but they had—he thought wisely—resolved to recommend the Council to leave prices as they were for another year. It would interest members to know that Glasgow had increased their price by 3d. per 1000 cubic feet, and Perth by a like amount; while several smaller towns had put their price up from 2d. to 5d. If the prices of coal did not return to a normal figure before another year, an increase in the price of gas must follow. Meanwhile, they could do without it; and it was to be hoped their action in this respect might tend to help many a one during the coming winter who would otherwise feel very severely the rise in the price of coal. He concluded by moving the adoption of the accounts, together with the estimate for the current year; and the motion was carried unanimously.

THE GAS SUPPLY OF BRIGHTON.

The Formation of the First Gas Company.

In the "JOURNAL" last week, we reproduced from the "Sussex Daily News" some particulars in regard to the early days of gas lighting in Brighton. We are now able, through the courtesy of Mr. R. Hesketh Jones, one of the Directors of the Brighton and Hove Gas Company, to supplement them by an account of the initial proceedings in connection with the formation of the first Company for lighting by gas the town which is regarded by many as the Queen of Southern Watering Places.

A meeting of the subscribers to the intended Company, and of parties desirous of being interested therein, was held at the Axe Inn, Aldermanbury, London, on the 24th of March, 1818, and a number of resolutions were passed. The first set forth that in the opinion of the meeting no time should be lost in forming a Company to carry into effect the desire of His Royal Highness the Prince Regent to have his Pavilion lighted by gas, as signified by the certificate of Sir Benjamin Bloomfield to Mr. Jonathan Taylor, and to exercise the powers and privileges granted to Mr. Taylor by the Town Commissioners to lay down pipes in the streets for the purpose of lighting the Pavilion and the town. The second resolution sanctioned the formation of the Company, with a capital of £25,000, divided into 1250 shares of £20 each, to carry out the scheme; and it was decided to apply for an Act of Incorporation. A certain number of the shares were to be reserved for persons residing in Brighton who might be desirous of participating in the undertaking.

The Mr. Taylor already referred to having for a long time incurred considerable expense and loss of time in obtaining the patronage of the Prince Regent for the lighting scheme, and in procuring the grant from the Town Commissioners for laying down pipes, the meeting decided that he should be remunerated for his trouble, either by a sum of money or in shares in the Company; and the amount was left to be determined by a Committee. Mr. Taylor had also, with the view of facilitating matters, supplied, at his own cost, upwards of £1000 worth of material which he considered to be useful and necessary for the undertaking; and it was decided that this should be purchased by the Company. Moreover, as it appeared to the meeting that his views in regard to conducting the concern "by procuring gas, coke, and lime by one carbonization" promised to prove lucrative if adopted, he was considered to be a proper person to superintend and control the works at Brighton under the regulations and directions of the Committee of Management.

Another resolution dealt with the constitution of the Committee (one member of whom was to be the Chairman), who were to superintend the affairs of the Company, and prosecute the application to Parliament; and they were empowered to award to Mr. Taylor and others, in connection with the formation of the Company, the necessary remuneration. Messrs. Masterman and Co., a firm of bankers in London, were appointed Bankers and Treasurers of the Company. Mr. William Cole was selected as the Solicitor to prepare the petition to Parliament and draft the necessary Bill, and Mr. Browne as the Parliamentary Agent.

The final resolutions were to the effect that Mr. Taylor was to wait upon the Town Commissioners and the several inhabitants who might be friendly to the undertaking, to solicit their participation therein and procure their signatures to the petition to Parliament; and as, with the view of saving expense, he had offered his gratuitous services as Secretary until the Committee should appoint a proper person to fill the office, he was requested to subscribe to the resolutions and act in the capacity named.

Appended to the resolutions were the names of the parties who had agreed to take shares, and the number (generally twenty) for which they subscribed.

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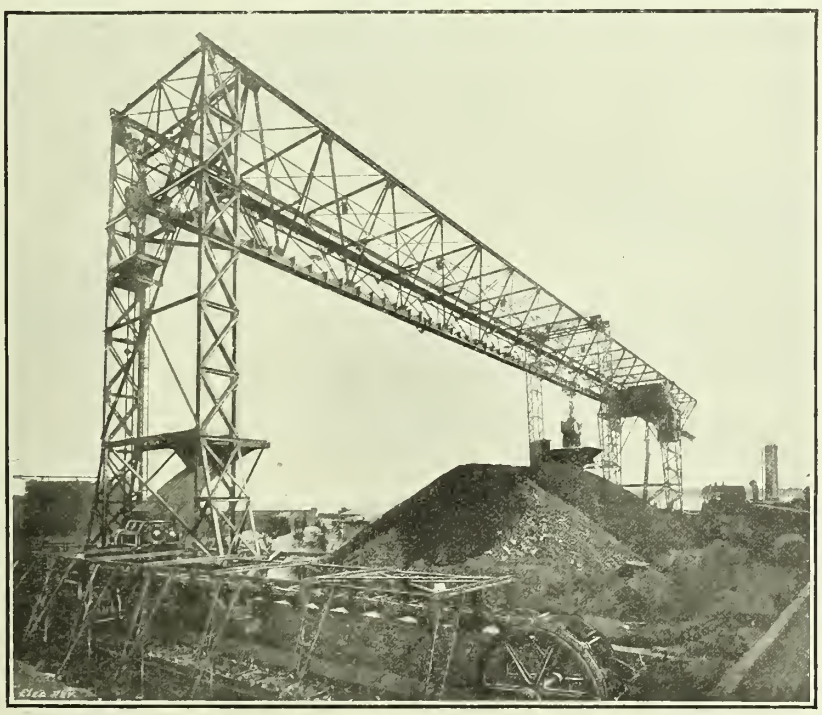

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THE BRAZILIAN TAX ON MONAZITE SAND.

The United States Consul-General at Rio de Janeiro has furnished a report to his Government on the Brazilian tax on monazite sand, concerning which he writes as follows :—

A number of inquiries sent by American manufacturers interested in thorium products with respect to monazite sand in Brazil, and especially to the Brazilian tax upon exports of the sand, indicate some change in the business in the United States which may be effected by Brazilian conditions. Contrary to the impression which seems to exist in the United States, there is no increase in the export tax on monazite in Brazil, though the practical effect of the course of business in this country has been such as to lead to conditions amounting to an increase. The Federal authorities continue to charge about 50 per cent. on exports ; or, rather, they allow the person handling the sand 50 per cent. of the sale value, taking the balance. In Bahia, the tax remains at 27 per cent. *ad valorem*, in addition to $4·85 per ton specific export tax. In Espirito Santo, the tax has been 20 per cent. *ad valorem*, *plus* £1 (or $4·86), £2, or £3 per ton specific duty, dependent upon whether the exporter, a third person, or the Government owns the ground from which the sand is taken. The State Legislative Assembly of Espirito Santo has been debating the question of an increase in the tax imposed by the State ; but as yet no action has been taken.

The quality of the deposits of monazite sand now being worked in Brazil is not so good as it was formerly. It is not so rich in thorium, and is more difficult to secure. So long as the tax on sand remains at the former figure, and while the percentage of thorium is decreased, there is, in fact, an actual increase in the tax on thorium, the valuable constituent of the sand. Taking the Brazilian fields as a whole, this decrease of richness, and corresponding increase of taxation, has been considerable. Exporters of the sand say that they can do no business in the United States because the present tariff of 6 c. per pound is, at 5 per cent. of thorium, an actual tax of $1·20 a pound, and is practically prohibitive to them. There seems to be a general feeling among those concerned that some material changes in Government regulations of the business are imminent. The exports of the sand from Brazil in 1906 amounted to 4,351,600 kilos. (9,573,520 lbs.), valued at $480,843, compared with 4,437,290 kilos. (9,762,038 lbs.), valued at $485,184 in 1905.

Crewkerne District Council and the Water-Works.—The proposal of the Crewkerne District Council to purchase the water-works makes slow headway. At the meeting of the Council last week, Mr. E. B. Taylor, the Engineer engaged by the Council to inspect and value the Company's machinery and plant, presented his report. He said he was of opinion that the sum of £14,335 was a fair value for the undertaking, and would be just to both parties. The Council postponed consideration of the report for a fortnight, in order that the ratepayers might have an opportunity of discussing it.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Aberdeen Corporation gas accounts, of which I gave a summary last week, were approved by the Town Council on Monday, after the usual explanatory statements by Bailie Kemp, the Convener of the Gas Committee. [Mr. Kemp's remarks appear in another column of this issue of the "JOURNAL."] The statement is interesting in that it gives emphasis to the impression that much can be done, in the shaping of the policy of gas undertakings, by the judicious exercise of foresight. This was one of the outstanding characteristics of the late Mr. A. Smith, who was for many years the Manager of the undertaking ; and it is being as fully exemplified in the management of his worthy successor—Mr. S. Milne. In Aberdeen, things are so conducted that before the necessity arises provision has been made for it. For that reason there never are any crises in the Aberdeen gas supply. It may be said that it is a much easier matter to conduct a gas undertaking in a city which is growing with continuous rapidity (as Aberdeen is) than in a decaying place ; and so it is, because the anxieties and worries as to how to get ends to meet from year to year are not experienced. But a growing city presents a much deeper problem to the authorities in charge of a gas undertaking than does a decaying one. In the latter case, the equipment exists, in capital and works, and the only question is how to apply them to the best advantage ; whereas in the former case, the future, with all its uncertainties, has to be gauged, and discretion requires a wide view to be taken of possibilities, and a liberal provision to be made for eventualities. That this is attended to in Aberdeen is well brought out by the fact that, at a time when extensions are costly, the capital expenditure during the year was only £3300, and yet, though the consumption of gas is rapidly increasing, there is no call for any augmentation in the expenditure of capital. The works and plant have been so attended to that they have borne the burden of an increased output without strain, and are capable of bearing a still greater burden. And, further, in the bearing of the increase in the immediately past years, they have enabled the Treasurer to lay up a surplus of £6385, which now, when the stress of dearer coal has come, has enabled the Council to go on for another year without raising the price of gas. This they are able to do by reason of their confidence in the elasticity of the demand for gas. With this confidence in their minds, they are content to face with equanimity an anticipated deficit, in the current year, of £1755, feeling certain that, should the coal market cease from troubling them by the end of the present year, they will be able to go on serving the community without varying their call upon the purses of the consumers. Bailie Kemp, the Convener, put the matter very sensibly indeed when he said that any increase in price should be the last resource, because of its disturbing effect on the calculations of consumers for manufacturing as well as for domestic purposes. This is an enlightened view which conveners

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would do well to take to heart, because there is no doubt that oscillations in price do check the demand for gas. But the Convener would not have been able to say what he did unless he had been in a position to offer more gas if it were required. So we come back to the reflection that the foundation of prosperity, in the case of gas undertakings, is to look well ahead in the matter of equipment, and not to wait till dire necessity requires schemes of extension to be proceeded with hastily, irrespective of cost to the undertaking, the public being meanwhile alienated by present-day inconveniences. The only individual item in Mr. Kemp's statement to which I would call attention is that in which he gives the increase in the number of cookers and heaters in use during the past two years. The increase amounts to 1128; and, though he did not say so, there is little doubt that it is due to the policy of encouraging the use of these appliances which was inaugurated about two years ago. It is also a result of the highly-successful exhibition of gas appliances which was held in the city in the spring of last year.

At a recent meeting of the Glasgow Town Council, at which the assessments for the year were fixed, Bailie Kirkpatrick, in submitting the estimates, said that the lighting establishment asked for an expenditure of fully £8000 more than last year. This was largely due to the increase of men employed, to some extent to increments in pay, and chiefly to the higher price of gas and to the additional consumption expected because of better lighting in many parts of the city.

The Elgin gasholder question comes to the front again. Agreeably to the promise made by Provost Christie to the objectors at the conference with them, an account of which was given in the "JOURNAL" last week, the Town Council held a special meeting on Monday to consider whether a compromise in the matter could not be effected. Provost Christie said his own idea was that perhaps the best compromise they could offer was to sink the gasholder in the site at the back of the North Lodge. There would be little difficulty, he thought, in going down a matter of 10, or possibly 15 feet. The depth would depend upon the nature of the subsoil. If the gasholder were sunk 15 feet, there would be very little of it seen above the roof of North Lodge, and then only when it was fully inflated. The sinking of it would cost at least £500 more, but he was sure the Town Council would be willing to incur the expense if thereby the objections of the householders could be met. He would like to add that he thought too much had been made of the leakage of gas. He found that if they were able to reduce the leakage by 5 per cent., which would bring it down to 12 per cent. —about as small as in any town of the size of Elgin—it would mean a reduction of something like 5000 cubic feet per day. This, upon a maximum consumption of 200,000 cubic feet per day, would practically make no difference in the size of the gasholder required. The waste was not at the works, but in the distribution of the gas. He suggested that a few high poplar trees might be planted at the rear of North Lodge, which would screen the gasholder a good deal from view. By sinking the gasholder 15 feet, there would be about 45 feet of it showing above the ground, and the height of North Lodge was about 40 feet. Bailie Davie pleaded for delaying the question, in view of the startling revelations the expert was making in regard to the leakage of gas throughout the town. Between his shop door and North Street, the expert had discovered a leakage of about 500 cubic feet of gas per day. This find, with other ten similar leakages, would add 5500 cubic feet per day, or 2 million cubic feet a year, to the gas supply—an amount which, at 3s. per 1000 cubic feet, would effect a saving of £300 a year. But he was in favour of the North Lodge site, if the gasholder could be sunk as proposed. Mr. Norris Mackay said that his objection was to the site altogether, and not to the height of the holder. There was now no present urgency in the matter. The gasholder could not be put up in time for this winter. It was a large question, and should come before the ratepayers. If the ratepayers decided that it was to be at North Lodge, he would not further oppose. Bailie Gordon, the Convener of the Gas Committee, moved that, in view of the indication which had been received from the objectors that any modification of the structural erection of the holder would meet with their approval, and inasmuch as the Council could see their way to lower it, intimation be given to the agent for the objectors that the Council were prepared, as far as possible, to lower the gasholder from 10 to 15 feet. Mr. Norris Mackay moved for delay, so as to give time to look out for another site; but his amendment was not seconded. Another was proposed, that the matter be delayed till after the November elections; but the Convener's motion was carried by 13 votes to 3.

In the North Berwick Town Council the other night, Mr. Nelson, the Convener of the Gas Committee, said that instead of increasing the price of gas, seeing that coal had gone up so much, the Committee were in a position to recommend that the price remain as formerly—3s. 6½d. per 1000 cubic feet. This he thought very satisfactory, when they considered that in other places they had found it necessary to raise the price. At one time he was rather doubtful whether they would be able to do what they proposed, but he now found it possible. The Committee further hoped to have a surplus at the end of the year. The Council unanimously approved of the recommendation. They further agreed to raise the price of coke from the existing price of 8s. 4d. to 10s. per ton, the advance to come into force immediately. The price of gas was reduced from 3s. 9d. to 3s. 6½d. in October last.

In the Newport (Fife) Town Council on Monday, it was agreed to place £250 out of the profits of the Gas Department to a reserve fund recently instituted, and to continue the price of gas for the current year at 3s. 10d. per 1000 cubic feet

It is reported of the Stonehouse (Lanarkshire) Gas Company that it continues to make progress; the consumption of gas for the past month having been 112,000 cubic feet more than in the corresponding month of last year. The increase for three months has been 218,000 cubic feet. The authority from which I quote adds that it may be of interest to weavers to learn that inverted incandescent gas-mantles can be utilized for the purpose of lighting weaving-shops. The apparatus has been fitted up in the office of the Secretary, for the purpose of showing the applicability of the light.

A LETTER WORTH READING.

TELEPHONES
—NATIONAL—
GAS OFFICES 234
—MUNICIPAL—
GAS OFFICES 743

ALL REPLIES TO BE ADDRESSED
J D ASHWORTH.
GENERAL MANAGER

Portsea Island Gas Fittings Company Ltd
Show Rooms.
Park Road.

Portsmouth 3rd August 19 07.

Messrs Bland & Co,

London.

Gentlemen,

In reply to your inquiry regarding Blands Inverted Gas Burners I have much pleasure in adding to the testimony of same.

I think it is sufficient recommendation in itself when I say my Company have fixed upwards of 3,000 of these burners in this town during the past year. They are of a decorative design and give a most satisfactory illumination at an exceptionally low gas consumption. Regarding cost of maintenance I have found this exceptionally low, in fact far below that of the up-keep of the ordinary vertical Incandescent Gas Burner. In conclusion I have no hesitation whatever in saying that I can strongly recommend them to Gas Lighting Engineers,

Yours faithfully,

J. D. Ashworth

General Manager.

Facsimile of letter received by Bland & Co., 63, Queen Victoria Street, London, and Manchester.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 7.

Sulphate of Ammonia.

With the covering of August contracts, the market assumed a quiet tone; buyers being disposed to wait in respect of their September requirements. But stocks in the hands of makers being inconsiderable, there has been no pressure to sell, and values remain without material alteration. The closing quotations are £11 15s. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There is also less inquiry in the forward position; buyers being discouraged by the firmness of makers, who are quoting £12 2s. 6d. per ton for October-December delivery, and £12 5s. per ton for delivery over the spring months. A certain amount of speculative selling abroad is reported at substantially below these figures.

Nitrate of Soda.

This market remains quiet but steady at 11s. 1½d. to 11s. 4½d. per cwt. for ordinary and refined qualities, on spot.

LONDON, *Sept.* 9.

Tar Products.

The market for tar products is without much change. Pitch appears to be rather easier, and manufacturers are willing to accept a reasonable figure for their makes to the end of the present year. Business has been done at 26s. on the east coast to the end of the year, and 26s. 6d. to the end of June next. On the west coast, manufacturers appear to be fairly well sold, and not very anxious for business. South Wales buyers decline to entertain any further quantity for delivery during the present year, and will now only buy at reasonable figures for delivery all over 1908. The Continental buyers seem to be indisposed to purchase just at present, and there will probably not be much doing until the end of the month. Creosote is very firm, particularly fn the North, where high figures are reported to have been paid for delivery f.o.b. In the Midlands, manufacturers still ask 3d. per gallon. In London, parcels have been sold at prices varying from 2¾d. to 2⅞d., while it is reported that some quantity has been sold at 3d. Benzol, 90 per cent., is quiet. There are sellers at 8¼d. to the end of June next, on the east coast, while London makes are said to have been sold at 8d. per gallon for prompt delivery. Benzol, 50-90 per cent., and toluol are both without any demand, and no sales of importance have been made. Solvent naphtha is quiet. Business has been done at low figures in the North, while it is understood that 1s. 2½d. has just been accepted for London makes. But in most cases manufacturers ask 1s. 3d. Carbolic acid is steady. Continental consumers refuse to advance their quotations, but manufacturers report that they are getting better prices than those offered by them. Crystals are quiet; and the last French Government contract was, it is reported, let at a very low figure indeed. Anthracene is without interest.

The average values during the week were: Tar, 15s. 3d. to 19s. 6d., *ex* works. Pitch, London, 27s.; east coast, 26s.; west coast, 25s. to 26s. Benzol, 90 per cent., 8d. to 8½d., casks included; 50-90 per cent., 8¼d. to 8¾d., casks included. Toluol, 10d. to 10½d., casks included. Crude naphtha, 4d. to 4½d., naked; solvent naphtha, 1s. 1d. to 1s. 2d., casks included; heavy naphtha, 1s. 0½d. to 1s. 1d., casks included. Creosote, London, 2¾d. to 2⅞d., naked; North, 2¾d. to 2⅞d., naked. Heavy oils, 3⅛d. to 3¼d., naked. Carbolic acid, 60 per cent., 1s. 8¼d., casks included. Naphthalene, £6 10s. to £12 10s., packages included; salts, 35s. to 40s., packages included. Anthracene, "A," 1½d. to 1¾d., casks included.

Sulphate of Ammonia.

This article is still fairly steady. The principal London Gas Companies' nominal price is £12 2s. 6d. to £12 5s.; and ordinary makes can be taken at £11 11s. 3d. to £11 12s. 6d. on Beckton terms. Leith remains at £12 to £12 2s. 6d. Hull may be taken at £11 15s. to £11 16s. 3d.: and Liverpool at £11 16s. 3d. to £11 17s. 6d.

COAL TRADE REPORTS.

Lancashire Coal Trade.

A rise of 1s. 8d. per ton for house coal, and 10d. per ton for steam fuel, has taken place without much demur. Steam users are clamouring for coal as eagerly as ever. During the last week in August, there were a dozen times as many orders for coal at the Lancashire collieries as there were in the corresponding week of 1906. The general demand during the summer was so much larger than usual that no stocks have been accumulated. All coal brought to the surface has been cleared off as fast as it was raised. Steam coal contracts are 3s. 6d. per ton higher than last year. Coal for shipping is in full request. There is not much doing in gas coal and cannel at present; but as winter approaches, all new contracts will have to be made at an increased cost. The average quotations at the pits are: Best house coal 15s. to 16s. 6d. per ton, seconds 14s. to 15s., common 12s. to 13s. 6d., burgy 10s. 6d. to 11s. 4d., best slack 9s. 6d. to 10s. 4d., medium 8s. 6d. to 9s., lower qualities 7s. 9d. to 8s. 4d., coal for shipping 13s. 6d. to 14s. 6d., furnace coke 17s. to 24s.

Northern Coal Trade.

Though there has been some hindering of shipments of coal owing to the lack of ready steamers, this difficulty is lessened, and heavy exports are now again being made. There is also a growing home consumption. In steam coals, the shipments to the Baltic are being pressed forward, and thus prices are very firm. Best Northumbrian steams are now quoted at about 16s. 6d. per ton f.o.b., second-class steams are steady at about 15s. 9d., and steam smalls are from about 10s. to 10s. 6d. There is some complaint as to the limited output of the collieries; but the production is often interfered with at this season by local holidays. In the gas coal trade, the local demand is increasing, and the exports are still very heavy. Durham gas coal varies from about 14s. to 15s. 6d. per ton f.o.b., according to quality, with a higher

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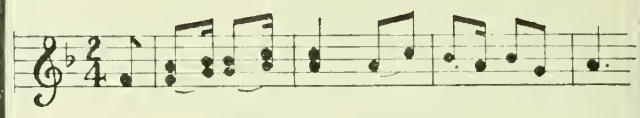
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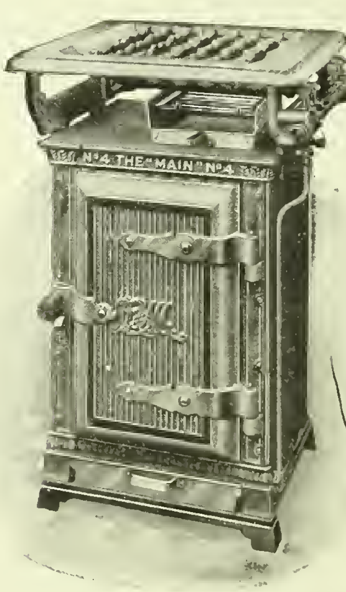
THAT'S ALWAYS SUNG WHERE

OUR COOKER IS IN USE.



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LONDON, GLASGOW, FALKIRK.

quotation for one or two special classes. As to contracts, there have been further sales of best gas coals for forward delivery—one of about 60,000 tons, at a price that is expected to leave about 13s. 9d. per ton f.o.b.; and some smaller quantities have been sold at 14s. per ton. For early delivery, there is very little coal free for sale, so that high prices are quoted for any that is still available. Coke is firm; and though the output of gas coke is increasing, it is well taken, with the prices steady at about 20s. per ton f.o.b.

Scotch Coal Trade.

Trade continues to be very brisk, with retail prices going up. In wholesale circles there is a panic among buyers, which is playing into the hands of the coalowners. For the next few weeks, perhaps months, the outlook is not very promising for those who are not under contract, as the immediate future is likely to see the tightest squeeze of the present boom. So far, there have been no complaints of short deliveries under contract. That is a matter, however, which owners of gas-works will do well to prepare for. The prices quoted are: Ell 15s. to 16s. 6d. per ton f.o.b. Glasgow, splint 15s. to 15s. 6d., steam 14s. to 14s. 3d. The shipments for the week amounted to 324,977 tons—a decrease of 4546 tons upon the preceding week, but an increase of 38,299 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,741,458 tons—an increase of 608,158 tons upon the corresponding period of 1906.

Manchester Gas-Workers' Wages.—Some weeks ago, a section of the employees of the Manchester Corporation Gas Department applied for an increase of wages and an extension of holidays; and when the matter came before the Gas Committee for consideration last Friday, Alderman Gibson, the Chairman, stated that on careful inquiry being made respecting the conditions of labour in other large gas-works, it was found that the men employed in Manchester were treated more favourably than in some other places, and quite as favourably as in any other gas-works, with perhaps one exception. Under these circumstances, the Committee regretfully decided that they could not comply with the men's request.

Lighting Schemes for Whitehead.—The Whitehead Ratepayers' Association lately called a meeting to consider various schemes of public lighting which had been drawn up by a Committee to whom the work had been delegated. Estimates were submitted of the cost of four systems—acetylene, oil gas, electricity, and petrolite. One estimate for acetylene was £1326, another £1441, and a third £1650. For oil gas, the total cost was put at £2640. One estimate for electric lighting was £2200; while another was £2168 for the complete work. An expenditure of £494 would be necessary to light forty lamps with vaporized petrol; the upkeep being estimated at £75 per annum. After some discussion it was decided that the best thanks of the ratepayers be tendered to the Committee for their labours during the past year on the question of public lighting, and that it be referred back to them for further consideration.

Overcome by Gas at Paisley.—On Saturday week, a family residing at Walker Street, Paisley, had a narrow escape from being suffocated by gas. In the morning, one of the tenants on the second flat of the tenement became aware of a strong smell of gas. He examined the fittings, but found nothing wrong; and he then suspected that the gas was coming from the house on the ground floor occupied by John Gray, his wife, and two daughters. Going downstairs, he knocked several times at Gray's door, but received no answer. Summoning assistance, he effected an entrance by the back window, when Gray, his wife, and daughters were discovered in an unconscious condition in bed; while there was a strong smell of gas in the house. Medical aid was summoned, and under treatment the two daughters soon recovered. The father and mother, however, were in a more serious condition. The cause of the escape of gas had not been discovered by Saturday evening.

Increase of Price at Ossett.—At the last meeting of the Ossett Town Council, the Gas Committee's minutes contained a recommendation that the price of gas should be increased 3d. per 1000 cubic feet, as from the reading of the meters next month. Mr. Robinson, in moving the confirmation of the minutes, explained that necessity had compelled the Committee to advance the price of gas. He said it was purely a question of coal supply; and if any vengeance was justified, it was against those who had the coal in the hollow of their hand, so to speak. "We are the victims of a combination," he added, "who are determined to have their full pound of flesh. We are the victims of a combine within a combine." Their coal this year would cost them £1200 more for the same quantity than it did last year; the net increase being £700. As they had not a reserve fund, they had to find another way of meeting it; and the only course was to increase the price of gas. The users of prepayment meters would be left alone. A proposal to abolish meter-rents concurrently with the increase in price was suggested; but it was not supported, and the minutes were passed.

New Joint-Stock Companies.—The "K and A" Water-Gas Company, Limited, has been formed with a capital of £20,000, in £1 shares, to "acquire a certain invention relating to the manufacture of water gas and semi-water gas and apparatus therefor, pursuant to an agreement with J. J. L. Van Ryn." There will be no initial public issue. The first Directors (not less than two nor more than five) are Messrs. H. A. Bartlett and J. J. L. Van Ryn, who have power to appoint another. The offices of the Company are at No. 39, Victoria Street, S.W. The Illuminating Engineering Publishing Company, Limited, has been formed with a capital of £2000, in £1 shares, to establish, print, and publish a magazine, newspaper, or newspapers, in London or elsewhere, for the purpose of furthering the interests of illuminating engineering, &c. There will be no initial public issue. One of the first Directors is Mr. Leon Gaster. The Rawcliffe (Yorks.) and District Gas and Coke Company, Limited, has been registered with a capital of £10,000, in £5 shares (1000 shares being 6½ per cent. preference), to adopt an agreement between the Gas and Water-Works Supplies and Construction Company, Limited, and the Gowerton and District Gas Company, Limited, and to carry on the business of gas manufacturers, &c.

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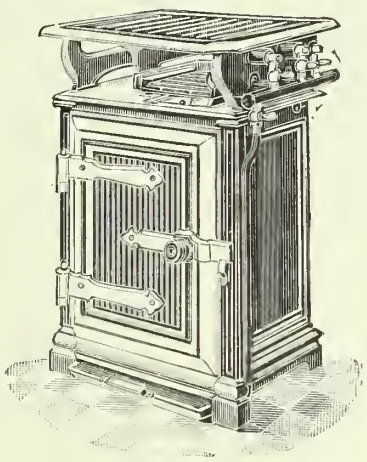

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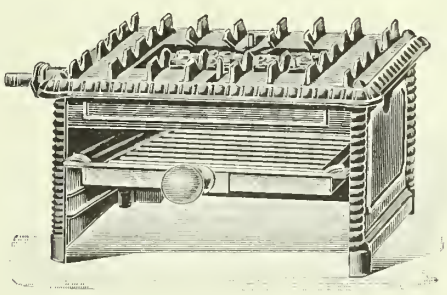


Telegrams: "AMOUR, LONDON."
Telephone Nos.: 1890 HOLBORN; CENTRAL 194.

A. G. CLOAKE,

54, HOLBORN VIADUCT, LONDON, E.C.

Coal Prices and Gas Profits at Batley.—At a meeting of the Batley Town Council, Mr. Kirby asked what effect the increased price of coal would have upon the finances of the town, and whether the Gas Committee would take any steps to stop the encroachment upon the profits of the gas-works. Mr. Childe replied that fully 2s. per ton increase was being paid on a contract of 18,000 tons; and this would mean £1800 less profit on the gas undertaking.

Serious Explosion at the Nice Gas-Works.—According to a telegram from the Nice correspondent of the "Star," a serious explosion occurred at the St. Roch Gas-Works last Friday. It appears that a valve on the inlet-pipe to the gasholder gave way, and the gas streamed back and became ignited by the furnace fires. The buildings were much damaged and several workmen were injured. A few particulars of the Nice Gas-Works, with illustrations, were given in the "JOURNAL" for the 11th of June last (p. 724).

Liverpool City Council and the Gas Supply.—By 21 votes to 19, the Liverpool City Council have rejected a motion proposed by Mr. Boote, in the following terms: "That a Special Committee be appointed with power to take evidence and make such inquiry as may be necessary, with the view to enable the Corporation to acquire their own gas supply for the requirements of the city generally; and that the Committee submit a report thereon to the Council at an early date." Mr. Walker, who seconded, remarked that an inquiry into such an important matter could do no possible harm.

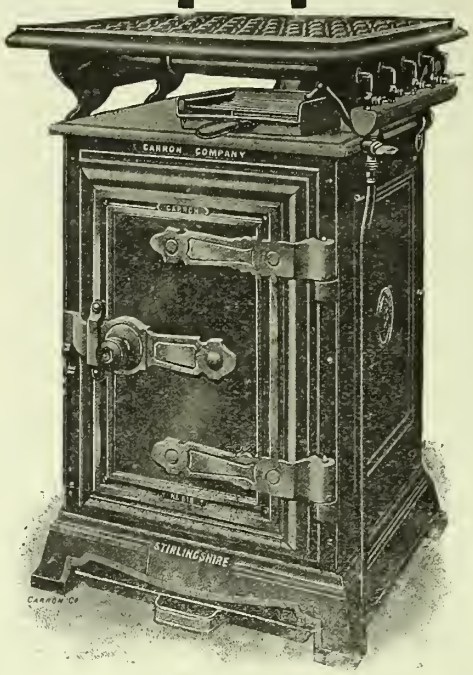
Lighting of Moreton Hampstead.—It is proposed by the Devon Gas Association to undertake the lighting of Moreton Hampstead by gas; and an agreement has been practically concluded with the parochial authority respecting the terms on which this shall be done. In the original draft agreement, there was a stipulation that the lamps should not be lighted for three days before and three days after full moon. The Parochial Committee were, however, of opinion that the lighting on these nights should be discretionary; and they inserted a clause to this effect, with the condition that payment for any additional lighting shall be *pro ratâ* with the ordinary charge.

Teignmouth Water Supply.—Progress is being made with the work of laying the main to supply Teignmouth with water from the new reservoir which is being constructed on Dartmoor by the Paignton District Council. A difficult section of the scheme is the crossing of the River Teign; but this work is well in hand, and it was reported at a meeting of the Council last week that the deepest part of the river had been crossed, and that by the end of the month this part of the contract will be completed. It is anticipated that the new supply will be available before next summer. Meantime, the water-rate has been increased from 1s. 4d. to 1s. 9d. for the half year; and it is anticipated that it will be further advanced. This, however, will be a small trouble compared with that which Teignmouth has experienced over its water supply in dry seasons.

A Retrospective Increase at Wigton.—The Wigton Gas Company having, like so many others, lately increased the price of gas, the Urban District Council have decided to ask for an abatement. Mr. Twentyman, who moved that this course should be adopted, said that, in the first place, he did not see how the Company could make the increase retrospective. They gave notice about Aug. 29 that the increase would date from July 1. Mr. Carruthers remarked that he was quite of Mr. Twentyman's opinion; he did not see how the Company could make the increased charge retrospective. Those who had consumed gas during July and until the third week in August, had purchased it at 3s. per 1000 cubic feet, so he could not understand how the price for that period could be raised to 3s. 4d. He quite agreed that the Council, being the largest customers of the Company, really ought to have gas on a lower basis. Another member added that there was a great deal of dissatisfaction in the town about the advance.

Projected Gas-Works Extensions at Wallasey.—In a report to the Committee, Mr. J. H. Crowther, the Gas Engineer at Wallasey, expressed the opinion that the time had arrived when, in order to keep pace with the demand for gas, the Council should consider the advisability of proceeding with extensions at the works. Referring to the matter at the monthly meeting of the Urban District Council, the Chairman of the Gas Committee (Mr. Eastwood) said the requirements of the district in the matter of the supply of gas were growing to such an extent that there was danger of the limit of the productive capacity of the works being unequal to the demand. It was estimated that the proposed addition would cost £90,000; but there was no reason why they should spend this money till the demand required it. The Committee, however, put forward the matter now so that they might be able to get the Provisional Order this year. He pointed out to the Council that the gas undertaking since its inception had handed over £80,000 in relief of the rates, though at the present time the ratepayers were supplied with gas at 6d. per 1000 cubic feet less than either Liverpool or Birkenhead.

The Public Lighting of Falmouth.—The question of the terms on which the contract for the public lighting of Falmouth should be renewed was discussed at a meeting of the Town Council on Thursday. The Gas Company offered to light, extinguish, repair, and clean the lamps for £250 per annum; the gas to be charged for by meter at the current rate. The General Purposes Committee recommended that the Company be informed that the offer would be accepted for one year. Mr. Chard, in moving that this recommendation be carried out, said the gas lighting had been done far better the past year or two than before. Mr. Cox proposed that the contract should be for three years; contending that on the terms offered by the Company for this period the Council would save money. Several members supported this view. Mr. Mead opposed an extension of the term or the acceptance of conditions which would bind the Council to a definite arrangement for lighting for a period of years at a definite price. If they were supplied by meter, they could have any hours of lighting they pleased. The Town Clerk, in answer to a question, said the Gas Company were prepared to enter into a contract for the lighting of the lamps on the same terms as before, provided the Corporation replaced all the old lamps by suitable incandescent lamps, and were also willing to take the contract for five years. It was decided that the General Purposes Committee should further consider the matter, and present another report.



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Hired out by all the leading Gas Companies and Corporations.

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INCORPORATED BY ROYAL CHARTER 1773

WORKS: CARRON, STIRLINGSHIRE.

SHOW-ROOMS:—LONDON (City)—15, Upper Thames Street, E.C.; (West End)—23, Princes Street, Cavendish Square, W.; LIVERPOOL—22-30, Red Cross Street; GLASGOW—125, Buchanan Street; MANCHESTER—24, Brazennose Street; BRISTOL—10, Victoria Street; NEWCASTLE-ON-TYNE—13, Prudhoe Street; BIRMINGHAM—218, 220, 222, Corporation Street; DUBLIN—41, Grafton Street.

A sum of £16,620 is to be borrowed for the purpose of carrying out extensions at the Middleton Gas-Works. The greater part of the money is to be spent on inclined retorts.

The decision of the Cuckfield (Mid-Sussex) Rural District Council to lower their well at Balcombe, with a view to increasing the water supply, has proved a wise one. The borehole has been lowered to a total depth of 390 feet, and a very large increase in the yield of water has resulted—more than sufficient, it is stated, to meet the needs of the Mid-Sussex area.

The 32nd annual report of the Public Works Loan Commissioners, just issued, shows that during the financial year 1906-7 the Commissioners made 906 advances for sums amounting altogether to £2,123,496. These figures are decreases of 124 in the number of advances, and of £142,809 in amount, as compared with the preceding twelve months. Of the above total of £2,123,496, £1,995,845 was advanced on the security of local rates, and £127,651 on the security of property. The average rate of interest receivable was £3 13s. 7d. per cent., against £3 13s. in 1905-6, £3 9s. 2d. in 1904-5, £3 5s. 9d. in 1903-4, £3 5s. 1d. in 1902-3, and £3 3s. 7d. in 1901-2.

The Local Government Board have sanctioned the borrowing by the Nelson Town Council of £22,000 for gas-works purposes, and £8700 for cookers and meters—the period of repayment to be ten years. The Board have also authorized the borrowing of £7100 (£5700 for mains and £1400 for a new driving-main); to be repaid in thirty years.

Last Wednesday evening, the members of the Lincoln Municipal Officers' Association, with a few friends, visited the Bracebridge Gas-Works of that town, at the invitation of Mr. John Carter, the Gas Manager to the Corporation. On arrival, the company, which numbered about eighty, sat down to a meat tea in a marquee which had been erected in the grounds in front of the works; and afterwards the works were inspected. Prior to the latter event, however, the Chief Constable (Mr. J. T. Coleman), as President of the Association, proposed a vote of thanks to Mr. Carter for his kindness in inviting them to the works and entertaining them to tea. The vote of thanks was accorded with acclamation; and, in replying, Mr. Carter gave a very lucid description of what was to be seen at the works, and detailed the various stages in the manufacture of gas from the raw coal. The party were conducted round by Mr. Carter and Mr. Mainwaring, the Manager of the Bracebridge works.

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No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ENGINEER (New Zealand). No. 4825. Applications by Sept. 17.
DRAUGHTSMAN. No. 4835.
TRAVELLER. No. 4833.
SHOW-ROOM ATTENDANT (Man and Wife). Heywood Gas-Works. Applications by Sept. 17.

Gas Literature Wanted.

L. P. LOWE, 1214, Polk Street, San Francisco.

Situations Wanted.

ANALYTICAL CHEMIST. No. 4837.
ENGAGEMENT IN GAS OR WATER OFFICE. J. F. Watson, Soham, Cambs.
GAS-FITTER, METER READER, &c. S. Wait, Swindon.
REPRESENTATIVE (GAS AND WATER). No. 4813.
WORKING MANAGER. J. Smith, Buckingham.
SITUATION IN GAS-WORKS. No. 4836.

Plant, &c., for Sale.

CONDENSER TUBES. Romford Gas Company.
TWO CORNISH BOILERS. Malvern Urban District Council.

Plant, &c., Wanted.

ROTARY SCRUBBER. No. 4834.
TELESCOPIC GASHOLDER. Midland Coal, Coke, and Iron Company, Limited, Newcastle, Staffs.

Patents for Sale.

RELATING TO GAS-BURNERS.

Company Meeting.

BRITISH GASLIGHT COMPANY, LIMITED. Offices. Sept. 25. 12 o'clock.

Stocks and Shares.

GREAT YARMOUTH GAS COMPANY. Sept. 26.

TENDERS FOR

Coke.

WANDSWORTH AND PUTNEY GAS COMPANY. Tenders by Sept. 23.

Lead and Compo. Pipe, &c.

RHONDDA URBAN DISTRICT COUNCIL. Tenders by Sept. 19.

Sulphuric Acid.

LEICESTER GAS DEPARTMENT. Tenders by Sept. 21.

Tar and Liquor.

BRADFORD GAS DEPARTMENT. Tenders by Sept. 19.
COLWYN BAY AND COLWYN GAS DEPARTMENT. Tenders by Sept. 24.
ISLE OF THANET GASLIGHT COMPANY. Tenders by Sept. 19.
MARKET HARBOROUGH GAS DEPARTMENT. Tenders by Sept. 21.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 682.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd. . . .	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Aug. 29	14	Bourne- 10 p.c. . .	27—28*	..	5 0 0
51,810	10	,,	7	mouth Gas B 7 p.c. .	16¼—16¾*	..	4 3 7
53,200	10	,,	6	and Water Pref. 6 p.c.	14½—15½*	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	245—250	..	5 0 0
300,000	,,	,,	9½	Do. New . . .	185—190	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref. .	115—120	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb. .	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c. .	116—119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c. .	87—90	..	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
150,000	20	July 12	8¼	Cagliari, Ltd.	26½—27½	+½	6 0 0
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref. .	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord. . .	106½—108½	..	4 12 2
1,443,280	Stk.	,, 29	5 2/10	Commercial 4 p.c Stk. .	101—106*	..	4 18 1
560,000	,,	,,	5	Do. 3½ p.c. do. .	98—103*	..	4 17 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—1.7	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk. . .	123—125	..	4 8 0
55,000	,,	—	4	Do. Deb. Stk. . . .	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd. . . .	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17½—18½	..	4 17 4
15,18:,590	Stk.	Aug. 15	4 4/10	Gas- 4 p.c. Ord. . .	93—95	..	4 12 7
2,600,000	,,	,,	3½	light 3½ p.c. max. . .	86—88	..	3 19 7
3,799,735	,,	,,	4	and 4 p.c. Con. Pref.	103—106	+1	3 15 6
4,193,975	,,	June 13	3	Coke 3 p.c. Con. Deb.	81—83	..	3 12 3
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental .	174—176	..	4 10 11
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93	..	3 15 3
195,2[illegible]2	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c. .	110—120*	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A	217—219*	..	4 11 4
718,100	,,	,,	7	Do. B	160½—16 ½*	..	4 6 8
152,736	Stk.	Feb. 14	7⅝	Maidstone 5 p.c. . .	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of 5 p.c. Deb..	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesb'd Con.	107—108	..	4 5 7
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19—20*	..	5 0 0
55,940	10	,,	7	Do. 7 p.c.	12½—13½*	..	5 3 8
300,000	Stk.	Apl. 26	8	Oriental, Ltd. . . .	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd. . .	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord. . . .	6¾—7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref. .	4⅞—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb. .	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord. . .	13—13½	..	5 18 6
312,650	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd. . . .	13—13½	..	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb. .	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	246—248	..	4 0 8
209,984	,,	,,	10	Do. B	246—248	..	4 0 8
523,500	,,	,,	10	Do. C	246—248	..	4 0 8
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	119—121	+½	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159—161	..	4 19 5
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	115—118	..	4 13 3
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	117—120	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord. . .	105—110	..	4 10 11
120,000	Stk.	Aug. 15	6¾	Tottenham A 5 p.c. .	120—123	..	5 9 9
398,940	,,	,,	5¼	and B 3½ p.c.	100—103	..	5 1 11
149,470	,,	June 27	4	Edmonton 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107—109*	..	4 11 9
30,000	Stk.	Feb. 14	8	Wands- A 5 p.c. . .	—	..	—
255,636	,,	Aug. 15	6½	worth B 3½ p.c. . .	128—133		4 17 9
75,000	,,	,,	5⅗	and C 3½ p.c. . .	—	..	—
80,075	,,	June 27	3	Putney 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord.	101—104	..	4 18 6
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	118—120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div."

The Neath Rural District Council have accepted the tender of Messrs. Morrison and Mason, of Glasgow, at £88,932, for constructing the dam for the Ystradfellte Water-Works.

The Glamorgan County Council have received numerous claims for damages for accidents upon the Mumbles road, which had been treated with tar to prevent the dust nuisance. Several horses had slipped on the road, and people had been pitched out of vehicles.

The new Company formed with a capital of 30 million francs for carrying on the supply of gas in Paris, the title of which is "La Société du Gaz de Paris," entered into possession on the 1st inst., and are conducting the business at the offices of the old Company (now in process of liquidation), No. 6, Rue Condorcet.

The Brighton Corporation have been informed by the Water Committee that from the profit balance of £6388, the sum of £2719 had been carried to the contingent fund; allowing £3669 to be carried to next year's account. A suggestion that the whole should be applied to the relief of the rates was not entertained.

In a statement of the liabilities and assets of the borough of Bolton on the 31st of March last, lately issued by the Treasurer (Mr. George Swainson), the gas and water undertakings, which are put down as having cost £740,665 and £993,903 respectively, are entered among the remunerative and realizable works, the surplus on which is £696,372. The unremunerative but realizable assets amounted to £39,970, and the surplus revenue to £33,666; making a total of £770,008. Deducting the unremunerative and unrealizable capital outlay, £484,373, there is a realizable surplus of £285,635.

The Monte Video Water-Works Company have just declared an interim dividend at the rate of 6 per cent. per annum for the half year ended June 30.

At the recent half-yearly meeting of the Sevenoaks Water Company, at which dividends at the rates of 10 and 7 per cent. per annum on the consolidated stock and ordinary shares respectively were declared, the Directors were authorized to apply for a Provisional Order to increase the capital by £30,000.

At the monthly meeting of the Belfast County Borough Council on Monday last week, Mr. J. A. Doran, in moving the adoption of the minutes of the Gas Committee, said it was very gratifying to state that in August they had had an increase of 7,279,000 cubic feet of gas; and everything seemed to be going on very satisfactorily.

Probably the most popular feature of the second Annual Carnival of the Barking Philanthropic Society, which took place on the 29th ult., was a balloon ascent by Mr. Percival Spencer. The task of filling the balloon, which was of 45,000 cubic feet capacity, was entrusted to the Barking Gas Company, who spared no effort to promote the success of the trip. The gas was pumped through a 6-inch pipe, connected with the trunk main; a start being made at half-past ten in the morning. An excellent pressure was obtained, and the balloon was half filled in 40 minutes. The gas was then turned off until two o'clock, when the process of filling was completed. The arrangements were carried out under the personal direction of Mr. W. B. Reidie, the Manager of the gas-works, and Mr. W. C. Dean, the outdoor representative of the Company.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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FOR list of towns in which Plant has been Installed, see advertisement in the "JOURNAL" for Aug. 27 last, p. 600.
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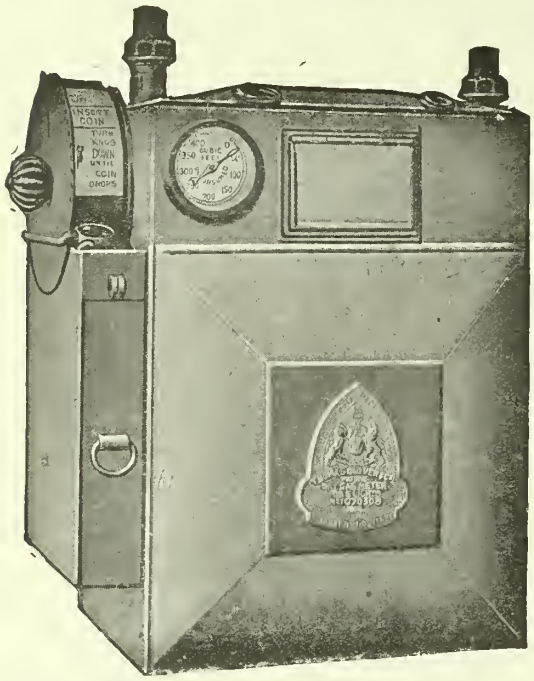

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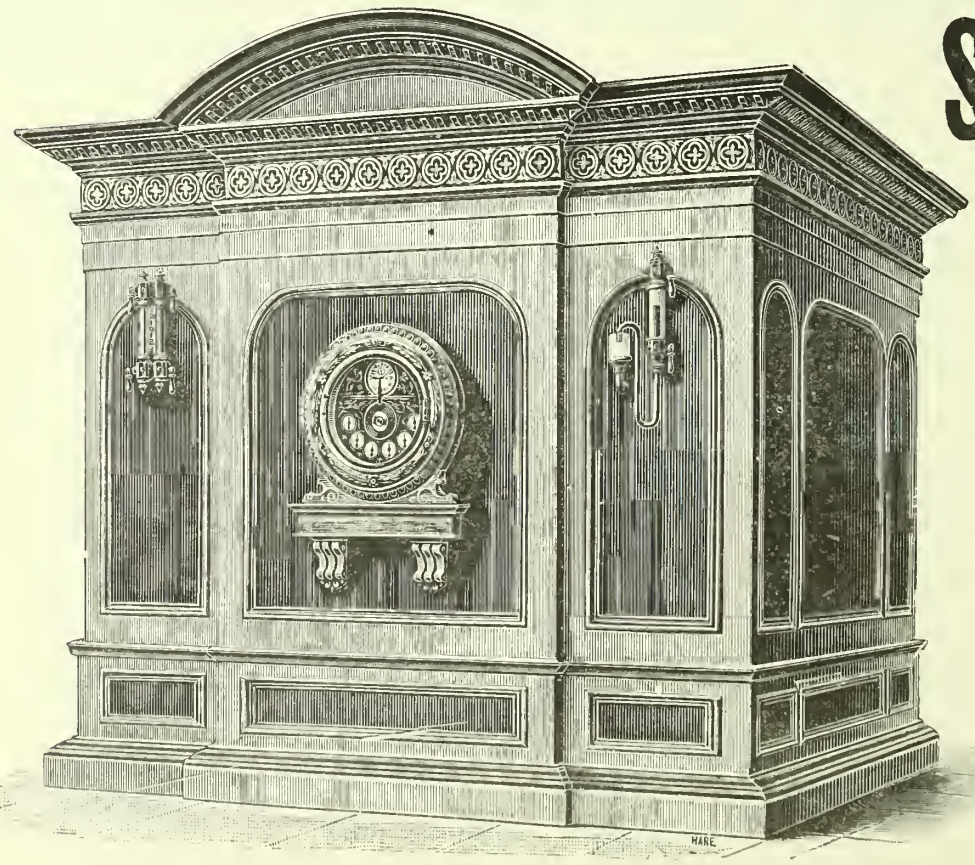

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EDITORIAL NOTES—GAS, &c.

Insurance Offices and Compensation.

WHILE the Council of the Institution of Gas Engineers are revolving in their minds whether anything can be done through them to secure for gas undertakings, from the insurance offices, terms, under the new Compensation Act, of a more reasonable character than the exorbitant ones already quoted, the support of several large gas undertakings is being lost by their several determinations to take upon themselves the more onerous risk rather than submit to the demands of the insurance offices. Of course, there is another way of looking at this gradual withdrawal of the interest of the large undertakings in any collective movement; and it is that their action will have the effect of hastening the breaking down of the exaggerated views of the insurance offices as to the addition to the risk that the new Act has imposed in the case of gas-works employees. The last undertaking of which we have knowledge that has receded from participation in any combined attack on the position of the insurance offices is, as mentioned recently (p. 559), the Liverpool Company; and previously we had noted the South Metropolitan, Sheffield, and South Suburban Companies, and the Edinburgh Gas Commissioners. Insurance offices have to bear this in mind, that they are driving from themselves the cream of the gas industry's business by their extravagant use of an opportunity; but there is no question they will have to climb down. We do not forget what Mr. Thomas Bower and Mr. Herbert Lees have told us of how the pressure brought to bear by the North of England Association, when the first Act came into operation, effected a reduction of the premium to 7s. 6d. and less per cent. on wages. And what happened then will happen again; and the sooner the insurance offices appreciate this, the greater the amount of business from the gas industry that will pass through their books. If they prolong the inevitable, the more undertakings will there be who will follow the example of those already named and possibly of others of prominent position of whose action we may not have heard.

We really cannot understand why the insurance companies have taken the view that 17s. 6d. and 12s. 6d. for the different classes of gas workers (with 3s. for the clerical staff) are fair premiums to demand under the new Act. There is nothing whatever in the experience of the past to justify such ideas. Taken as a percentage on the number of men employed, the risk in the case of gas-works employees cannot be nearly so heavy as in many other industrial occupations; and, indeed, with the greater adoption of mechanical operation in gas-works, there is less risk now than formerly. We have had contributed to our columns, by Mr. Hanbury Thomas, an excellent illustration from the experience at Sheffield of the modest amount of risk run by gas workers (*ante*, p. 248); and his computations are of guiding importance at this stage of the negotiations with the insurance offices. When the 1898 Act came into operation, it was determined by the Sheffield Gas Company's Board, on the direction afforded by prior experience, to set aside a sum equal to 6s. 8d. per cent. on the total wages, to meet the possible impositions of the Act. The amount accordingly set aside in the years since has been £2509, of which £1798 has been paid away in compensation, or 4s. 9·29d. per cent. on wages, compared with the provision of 6s. 8d. Had the Act passed in 1906 been in operation during the period, the amount of compensation that would have had to be paid would have amounted to £2286, or 6s. 0·84d. Under the circumstances, the amount of 6s. 8d. per cent. would have been sufficient; but it allows of no margin for any serious contingency. The Directors have therefore decided to set aside 8s. per cent. on the wages paid. Now this last figure is very interesting; and if the insurance offices really desire some corroboration as to its sufficiency, the experience of the South Metropolitan and South Suburban Companies may be offered. Excepting perhaps for the smaller concerns, Sir George Livesey is a firm believer in the advantages, for both men and companies, of "contracting out" of the Act; and this is a belief established on an experience of ten years in the case of the South Metropolitan Company, and five years in the case of the South Suburban Company. Last year accidents only cost the South Metropolitan Company an average of 4s. 9d. per man, or 5s. 6d. per cent. on wages; and this, be it marked, was not an exceptional year, but a fairly representative one. It is calculated by Sir George Livesey that the new Act will certainly not impose more than an additional 1s. 6d. per cent.; and therefore 7s. per cent. may be taken to cover the outside necessary provision in the case of that Company. This 7s. compares with Mr. Hanbury Thomas's 8s. per cent. on wages; so that at 8s., it would appear, we have the point of ample provision for fairly substantial undertakings. To go further, for ten years at Edinburgh, all claims arising out of the Employers' Liability and Workmen Compensation Acts have been paid out of current revenue. Totalling the claims paid, Mr. W. R. Herring has found that they average 2s. 9d. per cent. on the wages paid. Is it to be marvelled at, in face of the rates asked by the insurance offices, that Mr. Herring should have counselled the Gas Commissioners to continue their old practice, and let the insurance offices go their way without the gas-works business? At Bath, during the last six years, Mr. C. Stafford Ellery states, the claims received did not amount to anything like one-quarter of the sum paid in premiums.

In such a matter as casualties, the future can only be judged in the present by reference to the past; and we do think—having regard to past experience, the views of expert gas administrators as to a fair percentage on wages for premium, and the daily improving conditions in gas-works—that the insurance offices are making irrational demands upon the gas industry. Certain it is those demands have already deprived the offices of a substantial amount of business, and that they will not be entertained by many others.

Contracting-Out and Accidents Funds.

IN the foregoing article, the question is discussed as to what is, so far as can be calculated from past experience, a fair percentage on wages to provide for insurance under the new Compensation Act. A cognate question is that of contracting-out of the Act, with the provision of Accidents Funds, to avoid litigation between employers and employed. But, with the adoption of such a scheme, satisfaction has to be given that employers are not gaining an advantage at the expense of the legal rights of the men. A mutual arrangement, under definite rules, whereby contracting-out can be effected, must result not only in the avoidance of litigation, but in the prevention of strained relations, distrust, and the growth among the men of a sense of unfair treatment in forcing litigation, and so ruffling contentment. If contracting-out will maintain good relationships, then contracting-out of the Act is preferable to the Act itself, although the benefits to which the men are entitled may be made, at the money expense of the employers, superior to those payable under the Act. Like co-partnership, however, contracting-out does not spread in the gas industry. To the best of our knowledge, it only exists in the gas industry in the birthplace of co-partnership, and in the neighbouring South Suburban Company, which, as all in the industry know, is, like the South Metropolitan Company, governed, not merely by the usual commercial and industrial administrative laws, but by those unwritten ethical laws that are generated by co-partnership. There is no question that the co-partnership system does give a power in the matter of contracting-out that is not possessed by concerns where such a system is non-existent, though we do not go the length of saying that contracting out of the Act is impossible in the case of other concerns.

But in support of the main contention, the fact may well be advanced that, on a vote being taken of the workmen of the South Metropolitan Company, there were, even at those works, a few hundred (some of whom possibly did not understand what they were voting upon) who were in opposition to the Accidents Fund, while as many thousands were in favour. Had the system of co-partnership not been in existence in that Company, the probability is the numbers would have been reversed on account of one of the recognized difficulties to contracting-out.

For difficulties there are. The first does not apply generally, but it does in many cases. An undertaking must be a fairly substantial one, with a good number of employees, that can in this matter follow the lead in all respects of the South Metropolitan and South Suburban Gas Companies, but there are several of approximate size to the latter Company. And to all such, this subject must be of deep interest; for labour, backed as it is by a no small measure of law, has now made large inroads upon the consideration of all managements. A second difficulty is selfishness. Even though a Company might do as the South Metropolitan Gas Company and their neighbour have done—guarantee the financial stability of their Accidents Funds and the subscription of the necessary amount quarterly to make income balance expenditure, even though they show that they are doing something better for the men than the men would be getting under the Act, still in many works where relationships are not of the order obtaining in South London, there would be men who would sway their fellows to a suspicion of hidden advantage to the employers, and of the "some-"thing better" being a delusion and a sham, and not the equivalent of what would be obtainable through the Law Courts if to the Courts there had to be reference. Suspicion is a sinister enemy in large industrial establishments; and every effort should be made to avoid it. While, therefore, we are fully alive to the advantages of contracting-out of the Act in avoiding litigation and in maintaining good relationships, there is the feeling that something precedent is required to establish those good relationships and the utmost confidence to ensure smooth working. And the question is what are the best means of ensuring these precedent conditions? The most complete answer we believe is to be obtained at the gas offices in the Old Kent Road. This is merely an expression of our own opinion, and may not be acquiesced in by others. But we submit it as worthy of consideration in connection with a question of the hour.

The contracting-out and accidents fund schemes of the South Metropolitan and South Suburban Gas Companies is adumbrated by the rules, which we publish this week. Co-operation is at the root of the business of these Companies; and the scheme now before us is likewise based on co-operation in the prevention of accident, with co-operation in improving the financial condition of the sufferers by accident, without relieving in any way the Companies from any part of their legal financial responsibility. It seems almost paradoxical to say that the scheme will impose a greater cost per accident upon the Companies, and yet it will, or rather it is confidently expected that it will, save them cost in the total. The explanation is that co-operation will tend to the prevention of accidents; and that, as co-partners, it is to the interest of the men to do all possible to save expense to the Company. Their interest is a double one; being both co-partners and employees, with representation in administration. Under the scheme, the subscription of the men is a purely nominal one; but nominal though it be, a kind of sliding-scale has been applied to it. If the accidents are at the rate of 55 per 1000 men, the subscription is to be 1d. per man a month; if the accidents are at the rate of 40 and under 55, the subscription will be 1d. for every two months; and if under 40, 1d. a quarter. This nominal subscription will give the men a real interest in the fund, will diffuse among them the spirit of co-operation in its working, and will give them a large part in its management. The subscription of the men will only represent 12½ per cent. of the total cost; but the benefits assured to them in the event of accident are 25 per cent. higher, on the whole, than can be obtained under the Act. Thus it follows that of this 25 per cent., the Companies are making themselves responsible for 12½ per cent. beyond their legal obligations. The accident pay of the men is to be at the rate of 18s. a week, dating from the day of accident, but no claim can be made for less than three days' disablement. The 18s. means, on an average, a payment of about 1s. 6d. more than would be obtained under the Act. There are people who fear that this additional pay will increase the number of bogus accidents; but the system of juries (about which the rules also give information) and co-partnership supply very effectual safeguards for the Company and for those of their workmen who are too honest to descend to mean trickery, falsehood, and fraud. We like the idea of the men's subscriptions being varied according to the number of accidents, and of each station of the larger Company being treated separately. The rules appear on first acquaintance to be without defect; and it will be with interest that we shall watch the effect of their operation. Here we have not treated fully upon the benefits and conditions; those whose curiosity is aroused will naturally turn to the complete rules for further information.

Explosions in Electricity Culverts.

The trouble occasioned by explosions in electricity culverts appears to be a perennial one; but, as time passes, the burden of these mishaps is being lifted, to a considerable extent, from distributed coal gas. There was a period when the electricians imputed all manner of insidious mischief to coal gas. It was their trading rival; and, in their short-sightedness, it could be none other than coal gas that was the cause of trouble in and to their underground electrical systems. It sufficed them that coal gas and air would form an explosive compound, which an electric spark would ignite, and occasion a dislocation of cables and upheaval of manhole covers and flagstones. But that it was possible there might be some other cause was more than they would admit, and most certainly they did not exert themselves to search for an alternative. Then in 1895 there was the Euston Road explosion, when Major Cardew, one of the Board of Trade Inspectors, found incrustations on the insulators supporting the bare copper strips by which the electric current was carried; and further light on the subject shows us that these incrustations are, with moisture, of themselves sufficient, without the aid of coal gas, to create all the conditions necessary to produce explosions. We know, too, that an overheated cable with bitumen covering will generate gas; and, in a report from Aberdeen, a still more simple cause is now charged with being ample to realize an explosion and the dislodgment of manhole lids. Nevertheless, we cannot harbour the hope that electricians will not in future do all they can to entangle gas in their troubles, and attempt to make it a greater sinner than their own mischief-working systems. They seem to quite forget that, if it is a leakage of coal gas into their systems that causes the trouble, that leakage will not be discontinued by the explosion, but more likely will be worsened, and so be easily traceable. While arraigning gas systems for not being gas-tight (though gas suppliers have everything to gain by keeping the commodity they distribute in safe custody until sold), electricians also lose sight of the fact that electric wire culverts and boxes are frequently in such a condition that they give ready entry to accidental escapes of gas. Moreover, electricity has a bad habit of escaping from electricity distribution systems, and taking revenge upon gas-pipes in its own evil way, and in a way contributing to leakage. Gas suppliers are quite alive to the necessity of doing all possible in the interests of public safety; but electricians must not imagine that they are altogether blameless.

What has happened at Aberdeen? In the later nineties, there were explosions in electric light culverts; and manhole lids and flagstones were uplifted, and much damage was occasioned. These disturbances appear to have happened chiefly in culverts in which copper strip mains were carried. But coal gas was almost invariably accounted the cause, though sewer gas was occasionally suspected. Then three or four years ago the explosions took place at shorter intervals, and they have continued. But it does not appear to have occurred to anyone to see whether the Euston Road experience, and the valuable information contained in Dr. Bassett's paper read before the Liverpool Section of the Society of Chemical Industry (*ante*, p. 572) regarding the formation of incrustations of potassium and sodium hydroxides with free alkali metals, could be brought to bear upon the experiences in the culverts containing the bare copper strip mains at Aberdeen. We suggest that it is not now too late to give some attention to this question. But the more frequent recurrence of the explosions did do something for coal gas. It was exonerated in a few cases; and experiments resulted in the unveiling of a number of interesting facts. A temporary culvert with some boxes was constructed in the

electricity station yard, within the confines of which it may be imagined coal gas is not to be found, and trials were made with this structure. There is, however, a fault to be found with the investigations—that the conditions existing in the ordinary distribution system could not have been completely reproduced, inasmuch as a limited time and non-continuity of use were against the production of the state of things found in the Euston Road culverts a dozen years ago and of that described in Dr. Bassett's paper. But, restricted as these trials were, they proved that it was possible for an explosion to occur without the presence of coal or other explosive gas. The inquiry was made to ascertain "whether any explosive "gas was generated from the insulating material by the "intense heat of the fault [purposely created]; and it was "found on experiment that a piece of bare copper wire—if "short-circuited in the culvert—would create the same ex- "plosion, provided electrical energy sufficiently powerful "were applied. The experiments tended to show that the "explosions were in many cases brought about by the sudden "heating and consequent expansion of the air in the man- "hole and culvert." Cutting a ventilating hole in a manhole cover was not found sufficient to make any difference in the height the cover was lifted. The upshot is that the copper strip culverts in Aberdeen are now to be replaced on the solid system. It would have been better if the experiments had been carried out before the heavy outlay of the last eight years was made in the endeavour to remedy a condition of things that was not completely understood. However, the gas industry are indebted to Aberdeen for the investigation that has been made, and for the report thereon. That document (which we reprint in our "Miscellaneous "News") and Dr. Bassett's paper should induce more care on the part of electricians before indicting gas as the sole cause of explosions in their culverts and boxes.

The Old Order Changeth.

An important section of the "Journal" this week is devoted to the description of some of the new goods that the manufacturers of gas-fires and lighting appliances have produced or specially recommend for the coming season; and there are yet the novelties of other firms to notice before we complete the record. There has been much interest—both general and technical—extracted from the preparation of these accounts. In the first place, as we look down the lists of the names of the firms engaged in the manufacture of these appliances, the thought crosses the mind that for them the gas industry must be a very attractive trading field. In mind, we turn back to the period when the firms who had any considerable connection with the gas industry in the manufacture and supply of gas-lighting fittings and burners, could be counted on the fingers of one hand. Now——well, we have no particular concern in spending time in the attempt to count them. Incandescent lighting has changed the old condition of limited number, and has given place to the new. The old firms, too, who established their names and reputations in pre-incandescent days have, to their advantage, marched with the times; otherwise they would have been left in the rear by the fresh enterprise attracted to the gas industry. Not only have the firms multiplied and individually expanded, but the capital and labour employed in the production of appliances have had a manifold increase. The scientific advance and commercial prosperity of the gas industry have indeed opened up, to surprising extent, many channels in new directions.

Read down the accounts of the new goods now being put on the market, and see how almost completely, in the domain of lighting, the manufacturers are diverting their attention from the vertical incandescent burner to the inverted. This is significant of both efficiency and demand; and we look for still greater things. In the descriptions of burners, lamps, and fittings we also trace the line of progress. We see the shrinkage of gas consumption per burner; the higher illuminating duty per cubic foot of gas consumed. We see the appreciation on the part of the manufacturers of the important parts that regulation and cleanliness play in efficiency, and the provision for giving effect to these requirements. One drawback to inverted burners has been the discoloration and incrustations upon the metal heads and supply-pipe above. Two or three firms have dealt with this objection (which has only been tolerated on account of the excellence of lighting and, with the indicted exception, the decorative effect of the inverted burner); and one firm in particular have produced lamps about which we may say that it will surprise us much if they are not a success in permanently obviating all difficulty in this respect. Fittings and glassware, too, have more artistic merit than of yore. In the fittings provided for the bijou form of inverted gas-burners, we have examples of work that will vie with the best that has ever been produced for the carbon filament electric lamp. In glassware, the conditions favour greater artistic merit for gas; for no carbon filament electric lamp will stand being ensconced in a fancy coloured globe without forfeiting its usefulness as a light-giver.

The same with gas-fires. Improvement in efficiency and in the provision for the maintenance of the fires in good condition has been considerable. There are, it is true, croakers and grumblers about this point and that point; but we have never yet found a complainer in the ranks of the gas profession who could say to the gas-fire maker, "I can show you "how to produce something better." We all desire to secure betterment, and to cure defect. At the same time, we are not at all dissatisfied with what the gas-fire manufacturer offers to-day; and this can be said while still hoping for something better. But take the fires of to-day, and compare them with the fires of merely a few years past; those who cannot distinguish advance are suffering from an extremely obtuse comprehension. Advance is, as a rule, made by gradual steps; and we do not expect that in gas heating such a revolution in idea and system will ever be made as was effected in lighting in one step by Welsbach. But in gas heating as in gas lighting, "the old order changeth, and giveth "place to the new."

The Manchester Gas Exhibition.

The particulars received from Mr. H. Kendrick, one of the Honorary Secretaries to the Advisory Committee, which are given on another page to-day, are sufficient to show that a very strong bid is to be made for the favour not only of those connected with the gas industry, but also of the general public, in connection with the extensive Gas Exhibition that is to be opened in Manchester next month. There will be, according to the arrangements, an influential gathering of gas men at the opening, which is to be performed by the Lord Mayor of Manchester, assisted by the Mayor of Salford. Alderman R. Gibson, J.P., the well-known Chairman of the Manchester Gas Committee, is to occupy the chair; and the Council of the Institution of Gas Engineers will be present, together with numerous leading public men of the district. In the evening, the Advisory Committee are to entertain those taking official part in the ceremony and the Institution Council to dinner. Once started under such auspicious circumstances, the exhibition should straightway "catch on." All the arrangements are clearly in an advanced state; and the programme as foreshadowed is a highly attractive one. There are to be technical lectures by gentlemen whose names may be confidently relied upon for drawing good audiences; while for the general public, cookery lectures and cookery competitions have been arranged. The exhibits themselves will, of course, be on an extensive scale; and when all things are considered, it will be a surprise indeed if the Manchester Gas Exhibition does not turn out to be the signal success that is merited by the efforts of those who have been instrumental in organizing it.

The Accounts of Borough Councils.

From Part V. of the Annual Local Taxation Returns, which (though it was only issued last week) refers to the year 1904-5, there have been taken some figures which will be found in another part of to-day's issue. These Blue-Books (relating, as they do, to a subject which affects nearly everybody either directly or indirectly) are of much value for comparative purposes, though a considerable amount of courage must be summed up if one intends to dip very deeply into the volume which is now the subject of notice. It consists of over 400 pages—all of them, with the exception of a brief summary of the contents, being filled with column after column of figures. The information given is on the subject of the accounts of councils of boroughs other than Metropolitan boroughs, and those of urban district councils. The former only are noticed in this issue of the "Journal," as the "cherry" is one that quite well admits of two "bites" being taken at it. At the end of the year referred to, there were—exclusive of the City of London and Metropolitan Boroughs—

324 boroughs in existence, of which 71 were county boroughs; and the figures relating thereto are necessarily of very great magnitude. The total amount of loans at the conclusion of the period under review was no less than £232,244,589. This enormous sum, has, of course, been spread over a great many different branches; but by far the largest single item is water-works, on account of which a sum of £57,553,666 is outstanding. Gas-works (£19,753,565) and electric lighting (£18,794,239) come fairly close together; and between the two are tramways and light railways (£19,496,463). In considering municipal work at the present time, it would, of course, be unfair to omit reference to the burden of education cast upon the authorities, which the Blue-Book shows to be responsible for loans outstanding to the amount of £17,414,137. Another essential item is public roads and streets, for which there are loans of £26,303,292. The total rateable value of the boroughs is close upon £70,000,000; and the population, according to the last census, was about 13¾ millions. The table that is likely to be of most use to controversialists, as well as of greatest general interest, is that which relates to the transfers in aid of rates out of profits from, and the transfers from rates to make up deficiencies in revenue on account of, what are termed the "reproductive" undertakings. The particulars that have been gathered from returns made to the Local Government Board show that for the year 1904-5 there was a total profit of £898,742, and a loss of £242,472. By far and away the largest profit was made from gas-works, which were also responsible for very much the smallest loss. The losses on some water-works total to a considerably larger sum than do the profits on the others; while with regard to electric light undertakings the total losses shown in some cases come to much more than half the profit arrived at in others. Before leaving the subject, it may perhaps be again mentioned that the figures dealt with this week refer to the borough councils only, and not to the urban district councils, whose affairs occupy another section of the Blue-Book, and will be subsequently noticed.

Municipal Profits and the Rates.

The question of local government generally, and of municipal trading profits in particular, was dealt with at considerable length in a "breezy" speech delivered last week by Alderman David Wade, when presenting to the Bradford City Council his annual statement in reference to the trading departments of the Corporation. After he had sat down, one or two of his fellow members professed to have seen in what had been said great cause for mirth; but it seems, on the contrary, that there was in the Alderman's arguments sufficient food for quite a lot of reflection. Briefly, the case he put forward was that, while the receipts and expenditure of the Corporation's many trading departments should be so regulated as to leave sufficient margin for possible contingencies, the making of large profits simply revived the old question of direct *versus* indirect taxation. Taking the trading departments as a whole, the aggregate net profit shown a year ago was £365; and though this has been increased on the present occasion, it has only been in consequence of an equation scheme in connection with the water-works debt, which has resulted in substantial relief. Under these circumstances, the Alderman asked the Council whether, as advocates of the principle of cost price, their ambition had not over-reached itself. But by providing for contingencies, he did not mean the allocation of large profits to the relief of the rates, because he further put it to the Council as a proposition that, on general lines, ratepayers, who were legally the owners of all the public services within their area, could never make a profit out of themselves. Here it may be remarked that though, referring to the ratepayers as a whole, the proposition may be accepted, it is nevertheless a fact that the community can realize a surplus at the expense of individual members of it. That is to say, the electric light user can benefit himself by making the gas consumer pay such a price for his gas as will result in a large profit being allocated to the reduction of the rates. In this case, the gas consumer does not get back in lower rates all the extra sum he has paid for his gas, because non-consumers share the profits with him. And even if everyone used gas, small ratepayers might consume a lot and large ratepayers only a little; so that though taking the ratepayers as a whole—as a "conglomerate body," as Alderman Wade termed it—cost price and higher poundage rates may be the same as surpluses and lower poundage rates, in individual cases the two things are very different indeed. This is a further argument in favour of the Alderman's apparent desire to sell the municipal commodities as cheaply as possible, and save the shilling in the pound income-tax, otherwise handed to the Government—"just for the passing glory of a paper surplus."

National Free Labour Association.

With the air once more full of rumours of strikes, it is not without curiosity that one turns to the annual report of the National Free Labour Association—the fifteenth, by the way—which has just made its appearance, as a reminder that Trade Unionism has not by any means got all the field to itself. The Association numbers in its ranks 600,000 men; and during the past year 256 employers made application for workmen. It is thus a good deal more than a name; and at any rate in so far as it maintains the right of a man to decide whether or not he will belong to a Trade Union, the organization is one that is worthy of sympathy. It is impossible to dispute the justice of the contention that a man who prefers to be independent and free to dispose of his labour as he may deem best should not be deprived of his right to do so; and that there should be no power on earth which can deprive an employer from engaging the services of such a person, when both are willing to contract and agree upon the terms under which the service is to be rendered. A workman who finds he is not in sympathy with Trade Unions, but who (through fear of the loss of privilege to earn a livelihood in peace and unmolested) is forced to join one, is subjected to the self-same abridgement of personal liberty as is the employer who is coerced and intimidated into employing none but Union labour. The most important strikes defeated during the past year in which the services of the Association were invoked, were those of the Hull engineers, the Liverpool and Birkenhead iron-moulders, the Sheffield locomotive engineers, the Staffordshire engineers, the Leeds brassmoulders, and the Sheffield pattern-makers and steel dressers. The Association has therefore done something to justify its existence; and workmen as well as employers should be thankful for every step that is accomplished in the direction of breaking down, wherever it exists, the tyranny so frequently exemplified in connection with Trade Unions.

The entire length of the Bath road in the Hounslow district has been treated with a preparation of liquid tar as a dust preventive. The results are stated to have proved very satisfactory from the standpoint of the residents on the line of route. It is generally admitted that since the work of surface-dressing was completed the nuisance from dust has been greatly minimized.

Mr. Edwin Maidstone Pearson, of Edstone Hall, Wootton Wawen, Warwickshire, the Chairman of Messrs. Wilson Carter and Pearson, Limited, coal factors and exporters, who died in March last, left estate valued at £78,839 gross, with net personalty amounting to £40,538. Among the bequests are 250 shares in the Company and his thanks for their kind assistance and active co-operation to each of his assistants, Charles Ernest Murray, Alexander Watson, and Frederick Harry Tipley.

The wedding took place on Monday the 2nd inst., of Mr. Harry Pickford, the Manager of the Farnworth and Kearsley Gas Company, who a few years ago succeeded the late Mr. T. L. Sheppard. The bride was Miss Louisa Ainsworth, daughter of the late Mr. William Ainsworth. On the previous Saturday, a deputation representing the employees at the gas-works waited upon Mr. Pickford; and Mr. Ennion, the foreman, as the oldest employee, asked his acceptance of a handsome clock as a token of their esteem and good wishes.

The divining-rod expert who was sent by the German authorities to their colony in South-West Africa has been unsuccessful in his attempts to find water. It is stated that he succeeded in only one place—a valley where a chalk formation contained a great deal of water, and wells would have been successful if driven anywhere. In other places his predictions that water would be found at depths of 90 to 215 feet proved entirely wrong, as borings were carried down much below the indicated depth of the water-bearing stratum, but were perfectly dry.

"The connection between radium and the safe working of collieries does not at first sight appear to be a very intimate one," says "Nature;" but the discovery announced by Professors Elster and Geitel in "Die Welt der Technik," that fire-damp contains six or seven times the amount of radium emanation that is generally found in the air of coal mines, brings the two into close relation with each other. According to our contemporary, "comparative tests of the electrical conductivity of the air due to the presence of the emanation can readily be made by means of a simple aluminium foil electroscope; and as only a comparatively small sample of the gas is necessary, the tests may be carried out outside the mine. It will be interesting to see the electroscope become part of the normal equipment of a colliery."

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 781.)

It was only natural that business on the Stock Exchange should be on a very restricted scale last week; for, in addition to autumn influences, a Hebrew festival lightened the load, and the fact of its being Account week kept fresh business under. But in spite of all this, more cheerfuluess asserted itself from the start, and robustly maintained its position up to a point when other considerations had their turn. These were mainly the usual and almost inevitable realizations to secure profits after a rise. But they were not formidable. The factors at the opening were favourable; orders to buy for investment again appeared; and the fine weather, conducive to good traffic, had a brightening effect on Rails. Consols rose $\frac{1}{16}$. The cheerful and buoyant spirit animated Tuesday's dealings also. Consols gained another $\frac{3}{16}$, and most other markets smiled sympathetically. Wednesday was fully as fair, with the prospect of a light and easy account; Consols and Rails were still on the up-line; and so the general position continued through the following day. On Friday, the process of profit-snatching supervened, and a more or less general check was sustained all round. On Saturday, things did not mend; Rails being specially dull as they awaited the Labour *coup de théatre* of the next day. In the Money Market, there was an abundant supply, which the moderate demands of the week could make no impression on; and rates for discount, after some oscillation, closed easier. In the Gas Market, the volume of business was much about on a level with the week before. The general tendency was quite favourable; and all the six or eight changes in quotation were in the upward direction. In Gaslight and Coke issues, a fair amount was done in the ordinary at even figures, ranging from $93\frac{1}{2}$ to $94\frac{5}{8}$. Of the secured issues, the maximum was most dealt in at from $86\frac{1}{4}$ to $87\frac{1}{2}$; the preference was done at 105; and the debenture at 83. South Metropolitan was very quiet, with only four transactions at from 120 to $120\frac{1}{2}$. Commercial, on the other hand, was much more active; and the 4 per cent. changed hands several times at from $102\frac{1}{4}$ to 104. In the Suburban and Provincial group, Alliance old fetched $20\frac{15}{16}$ and 21, British $42\frac{1}{4}$, Brentford new 187 and 188, South Suburban 115, Wandsworth "B" 128, and West Ham 103 and $103\frac{1}{2}$. The Continental Companies were inactive. Imperial marked 175 and $175\frac{1}{2}$, ditto debenture $91\frac{1}{2}$, Union 114, and European fully-paid $23\frac{1}{4}$. Tuscan debenture was done at 101 and $101\frac{1}{2}$. Among the undertakings of the remoter world, Bombay new changed hands at $4\frac{31}{32}$ and 5, Buenos Ayres at $11\frac{3}{32}$, Hong Kong at $19\frac{7}{8}$, Monte Video at $11\frac{1}{4}$, Primitiva at $7\frac{1}{8}$, ditto preference at $5\frac{1}{8}$, ditto debenture at $95\frac{1}{4}$, and River Plate at $13\frac{3}{8}$.

ELECTRIC LIGHTING MEMORANDA.

The Visual Depreciation of Low Power Street Lighting by Excessive High Powers—Variegated Electric Lighting—Dirty Lamps and Artistic Columns—Failures Produced by Small Causes—The Parliamentary Session—Power and Supply-in-Bulk Companies.

Data respecting public lighting are always interesting in view of the keen competition between gas and electricity for the supply of the street lamps. To Mr. Francis Teague, the City Electrical Engineer of Bath, we are indebted for particulars of the results of his inquiries on the subject in 41 towns. The character and type of the lamps used in street lighting are much a matter of individual preference on the part of town officials; but it is the electrical engineer who has done more than anyone else to introduce into our streets a grotesque disuniformity of illumination. Upon this point, Mr. Teague's report is silent. Electrical engineers employ in some streets strong centres of illumination, the diffusive power of which is small in comparison with the candle power; and, in different parts of the streets of a single town, flame arc lamps, and arc lamps of the open and enclosed types are to be found. Then again in some towns Nernst and electric incandescent lamps are also fixed; while, in other parts, ordinary incandescent gas-lamps are plentiful, for the sake of economy and efficiency. What are the results? The disparity of lighting by the use of the large candle power but concentrated illumination lamps has been hugely increased; and the colour of the illumination has been variegated. But perhaps there are people—electricians for instance—who prefer this variety to what they would describe as a monotony of intensity in illumination, however desirable that may be in the causes of good lighting, safety, and eyesight. There is still another effect. The high illuminating power lamps cannot—economy forbids—be placed in the side streets. Consequently, pedestrians and drivers of vehicles pass from streets containing the excessively high illuminating power lamps into those less brilliantly illuminated (but which were formerly regarded as being well lighted), and to their eyes—having just been under the influence of the glare of high-power lamps—these streets appear to be in almost dense blackness. There is no necessity for this. We walk in the streets of London suburbs that are lighted by ordinary low-power (say, 60 or 70 candle power) incandescent gas-lamps; and the streets are well lighted. We turn from a main street in London illuminated by high-power flame arcs into residential thoroughfares illuminated by low-power lamps; and the eyes take some minutes to get accustomed to the illumination afforded by the much lower candle power lamps employed, though they are the same that are efficiently lightiug suburban roadways bordered by residential premises, gardens, and trees. If in the main streets lamps of good, but of less intense and localized, illumiuating power were used at more frequent intervals, the eyes would not be so strained that a sufficient illumination for all purposes in the side streets is rendered artificially deficient. In other words, there is a visual depreciation of the low-power lighting by the use of the excessively high-power and eye-abusing lamps.

To turn to Mr. Teague's figures. The number of arc lamps installed in the 41 towns is about 12,000. But seven of the towns have upwards of 500 lamps; Edinburgh has 1176, and Glasgow 837. The average for the others is therefore not great. Of the total, 9377 of the lamps are of the open type, 2007 are of the enclosed type, and only 377 are flame arc lamps. Seeing that 105 of these flame arcs are in use in Hastings, and 105 are being erected in Hackney, there are only 110 flame arcs left to divide among the remaining 39 towns, or an average of rather more than four per town, which suggests that there are many electrical engineers who are not altogether favourably disposed towards the flame arcs. It is interesting to note that the flame arc lamps at Hackney and Hastings are of the magazine type; and it would be of value to know whether the reduction of labour for trimming produced by the magazine is more than counterbalanced by the increase in the cost of repair brought about by the magazine mechanism. In 29 of the 41 towns incandescent and Nernst lamps are also used; the total number of lamp columns bearing such lamps being 8760. This shows that electrical engineers are not of one mind as to the use of these inefficient lamps for street purposes, with all the worry and complaint that they bring in their train. Another point is that the number of arc lamps trimmed and cleaned per day per man varies from 30 to 100. Upon this point, the "Electrician" remarks: "At the present time, when the competition between electricity and gas for street lighting is so very keen, it is specially important that arc lamps used for public lighting should be maintained in as efficient state as possible. Arc lamp columns have the advantage of being more artistic than any gas standards yet devised; but dirty or badly illuminated arc lamp globes are very conspicuous, and are more noticeable than broken gas mantles." This reproof is much needed, not only in London, but in several provincial towns; and it is to be hoped it will be heeded. But we are not going to admit that electric lamp columns are more artistic than gas-lamp columns. Some very ugly arc lamp columns are to be found, and some of good design. Old-fashioned and ugly gas-lamp columns and artistic ones are likewise in existence. The sweeping and dogmatic assertion of our contemporary is certainly not justified. It is the parsimony exercised by local authorities towards the older illuminant and their misplaced generosity towards the newer one that gives partial truth to our contemporary's assertion, and nothing more. What reason is there that tall ponderous creations should be more artistic than shorter and lighter structures? Artistic gas-lamp columns can be made more cheaply than artistic arc lamp standards, and that is an advantage on the side of gas. Our contemporary also says that, "when the lamps are properly adjusted as regards voltage, careless centring of the carbons or worn guides may cause a poor and unsteady light." We are quite prepared to agree that these things not only "may" but do cause a poor and unsteady light; and however well lamps are adjusted to voltage, the wide fluctuations of pressure are often such a trial to the adjustment that the effect cannot be hidden from public gaze.

From little causes spring big results. It was only a defect in the boiler-feed arrangements at the electricity station on a Saturday night just recently that (so one report states) put Huddersfield in "almost total darkness" for over an hour. There are just two points about this statement that are peculiarly interesting. Firstly, the event occurred, as so frequently happens, on the worst night of the week—Saturday. Secondly, the report says the town was put into "almost total darkness." Have we been under a misapprehension in believing that Huddersfield possesses a gas undertaking of no mean order, and that the volume of business and the revenue considerably exceeds that of the electricity concern? If we have not been mistaken, then the report, iu alleging that the borough was in "almost total darkness," overstated the effect of the defect in the boiler-feed arrangements at the electricity station. Then at Hull, it was only a fire in a pavement box that produced a considerable amount of inconvenience lately; certain places of worship being amoug the premises deprived of light. Places of worship ought not to commit themselves to any system of lighting that only provides so narrow a margin of safety.

A reviewer of the legislation affecting electric lighting in the past session has not much ground over which to roam. The session was a particularly slack one—in fact, in the past two years, there has been a dropping off in the number of applications for new or additional powers. We only count the confirmation of 23 Electric Lighting Provisional Orders last session; and there are a few local authority Acts which in small part include powers referring to electricity supply. There is also the North Metropolitan Electric Power Supply Company's Act; and in the Grays and Tilbury and Shanklin Gas Companies' Acts, electricity supply is mentioned. Regarding London, the preamble of the County Council (Electric Supply) Bill was not proved; the Administrative County of London and District Electric Power Bill was withdrawu; and

the London Electric Supply Bill (the one promoted jointly by the Companies) met with a similar fate. It is considered by the "Electrician" that, inasmuch as the existing County Council are not likely to promote another Power Bill, and as the promoters of the Administrative County of London Bill have given up their quest for powers, it is probable we have heard the last for some long time to come of the London power problem. May it be so. But it will depend upon the amount of influence that the Progressives can bring to bear upon a plastic Government whether or not there will be an early revival of the question. The interview leading Metropolitan Progressives had with the Premier and the President of the Local Government Board is still fresh in memory; and though the Premier is not desirous of having London questions brought forward in the session of 1908, he has made a promise that they shall not be neglected. The only other point of interest about the work of the session is that an electrolysis clause, at the instance of the Metropolitan Water Board, was inserted by a Commons Committee in the North Metropolitan Electric Power Supply Act; but it caught the eye of the Lord Chairman, and was promptly removed. Thus an individual who is not the King has the power of rejecting the work of a Parliamentary Select Committee. Just one more point. Our friends of the "Electrician" hope the President of the Board of Trade will find time to recast the legislation relative to electric supply. The hope is a right one. While Mr. Lloyd George is doing this, he might straighten out things as between the electricity and the gas industries by making compulsory the testing, under prescribed conditions, and the stamping of all electricity meters fixed in future, and within a defined period of all now fixed, and by prescribing penalty testing for electricity supply. The law ought not to be sterner for gas than for electricity.

The cry has been heard loud and long that the supply of electrical engineers is greater than the demand. If successful power and bulk supply companies covered the land, the cry would be still louder; for the positions available for the technically trained man would be very materially limited in number. We are told that the Yorkshire Electric Power Company are now supplying, or have contracts to supply, eleven electric lighting undertakings, are negotiating for several more, and the Brighouse Corporation are the last who have fallen into the Power Company's net. The Brighouse Council are going to discard their own generating station, take electricity in bulk from the Company, and then save money at the price of £6 per kilowatt of maximum demand, *plus* ¼d. per unit for all units consumed. But the charge made on this scale will not exceed 1·25d. per unit for the whole supply. When the Brighouse station has been superseded, what need will there be for anything more than a commercial manager, with sufficient knowledge of distribution and utilization to carry on the business? Such a man will be of less value than one with the responsibility of the generating plant as well as the work of generation on his shoulders. But the Yorkshire Company, notwithstanding their success in connecting up so many local authority supplies, were last half year short by £403 of making £4700 income cover works costs and administration expenses. It requires a big business in low-priced electricity to make a financial success of power and bulk supply. Meanwhile, the South Wales Electrical Power Distribution Company appear to be breaking up. The last piece of news about them is that the Bridgend Town Council are buying the Company's local generating station and network for £5000. The station cost £38,700! It's an ill-wind that blows nobody any good; but the shareholders of the Power Company have forsooth had a big share of ill-wind.

Junior Institution of Engineers.

A considerable number of members of the Institution last Saturday week paid a visit to the Hampton works of the Metropolitan Water Board, through arrangements kindly made by the President, Mr. William B. Bryan, M.Inst.C.E., Chief Engineer to the Board. Under the guidance of Mr. Walter Hunter, Assoc. M.Inst.C.E., Assistant Engineer of the Western District, and a member of the Institution, they were shown over the extensive works on the north bank of the Thames, comprising intakes, reservoirs, filter-beds, and pumping machinery for the supply of the western and southern districts; the former having previously been the West Middlesex and Grand Junction works, and the latter the Southwark and Vauxhall. The fine series of pumping-engines of various types, probably the most varied to be seen collectively anywhere, were examined with great interest. At the conclusion of the inspection, the party, assembling in one of the engine-houses, were entertained to tea by Mr. Bryan; and a vote of thanks was passed to him, on the proposal of Mr. Lewis H. Rugg, Chairman of the Institution. On Thursday afternoon, the 26th inst., an official visit of the Institution will be paid to the Engineering and Machinery Exhibition at Olympia.

Lectures at the Engineering Exhibition.—In view of the success attending the lectures delivered during the course of the Engineering Exhibition at Olympia last year, arrangements have been made for another series at the exhibition to be opened on Thursday. On Saturday, Mr. Hal Williams will lecture on "Gas-Engines and Suction-Gas Plants;" on the 28th inst., Mr. A. E. Battle will deal with "Sanitation and Ventilation;" and on the 10th prox., Professor Henry Adams will discourse upon "Ferro-Concrete."

THE FORTHCOMING MANCHESTER EXHIBITION.

Readers will be interested to learn the progress of arrangements in connection with the forthcoming Manchester Gas Exhibition; and Mr. Henry Kendrick (Stretford), one of the Joint Honorary Secretaries of the Advisory Committee, has forwarded information which enables us to state what has been settled up to the present time.

The official opening of the exhibition will be carried out at 3 p.m. on Oct. 23 by the Lord Mayor of Manchester, assisted by the Mayor of Salford; the chair being occupied by Alderman R. Gibson, J.P., Chairman of the Manchester Gas Committee. Alderman F. S. Phillips, J.P., Chairman of the Salford Gas Committee, is to be asked to take part in the proceedings, as well as dignitaries of the surrounding towns who are patrons of the exhibition. The ceremony will also be attended by the Council of the Institution of Gas Engineers, who will hold their autumn meeting in Manchester for the purpose; and it is hoped that some of the leading members of the Manchester District Institution of Gas Engineers will take a prominent part in the proceedings. The Manager (Mr. W. Cawood) will entertain the visitors and others after the ceremony. In the evening, also, the Advisory Committee will entertain those taking official part in the ceremony, and the Council of the Institution, to dinner at the Midland Hotel. Gas engineers and members of Gas Committees and of Boards, as well as representatives of the exhibitors and the Press, will be invited to be present.

Among the attractions of the exhibition, there have been arranged a course of technical lectures by Mr. Dugald Clerk, M.Inst.C.E.; Professor J. B. Cohen, Ph.D., B.Sc., of Leeds; Mr. J. W. Graham, M.A., of Victoria University; Mr. R. H. Clayton, B.Sc., F.C.S.; Mr. J. H. Brearley, of Longwood; Mr. J. G. Newbigging, M.Inst.C.E., of Manchester; Mr. S. Mennier, of Stockport; Mr. Tim Duxbury, of Oldham; and Mr. Kendrick. There will, in addition, be a course of thirty cookery lectures (delivered in the afternoon and evening) by Mrs. Middleton; while a series of cookery competitions for school children have been arranged, in connection with which some valuable prizes and diplomas will be awarded.

It may be mentioned that the list of exhibitors now numbers fifty-four; and there are eighteen in the model class—it being hoped to show a complete model gas-works, and many other interesting objects. In addition, there will be many processes in operation; and arrangements have been made to run a number of models and other exhibits with power produced on the premises. The lighting of St. James's Hall, where the exhibition is to be held, and the annexes, has been divided among eight firms of repute; and the question of ventilation has received very special attention. To the disgust of some of the local plumbers, an exceedingly generous spirit has been manifested by the Manchester Gas Committee, who, in addition to supplying the gas at a very low figure, have laid all the pipes in the hall right up to the stands, so that the expenses of the exhibitors in this respect will be extremely small.

Steps are to be taken to arrange for a meeting of the North of England and Midland Gas Associations during the exhibition; and a joint meeting of the Junior Gas Associations will also take place. In view of this, it is to be hoped that the Railway Company will see their way to grant some substantial concession in the matter of tickets. In this connection we learn that they have been asked to fix special fares for all gas-works people visiting the exhibition, as well as to arrange excursions from all the surrounding towns. The attendance will doubtless be largely augmented in consequence of the issuing by Mr. Cawood of slips to all gas undertakings in the area advertising the exhibition, and having a coupon attached admitting consumers at half price. These will be distributed with next quarter's gas accounts.

Enough has been said here to give ample promise of a thoroughly successful show.

MUNICIPAL INCOME AND EXPENDITURE.

Figures Gathered from the Local Taxation Returns.

When noticing the Annual Local Taxation Returns, it is always necessary to point out that somewhat of their interest is lost owing to their lateness of publication. It is true that on the present occasion Part V. has been issued some five or six weeks earlier than was the case last year. Still, as it refers to 1904-5, it is even now (though perhaps unavoidably) more than a little belated. Nevertheless, the authentic character of the figures, and the completeness with which they are set forth in the formidable Blue-Book referred to, must be set against any shortcomings on the score of age, and render them of great value to those concerned in questions of municipal government. The statistics, it may be mentioned, deal with the accounts of the councils of boroughs (other than Metropolitan Boroughs) and of urban district councils. The present notice will be confined to the figures relating to the borough councils; leaving those of the urban district councils for a subsequent issue.

The number of boroughs (exclusive of the Metropolis) in existence at the end of the period embraced by the Blue-Book was

324, of which 71 were county boroughs. The variations, compared with the previous year, arise from the constitution during 1904-5 of one new borough (East Ham) and two county boroughs (Blackpool and Tynemouth). The accounts of the borough councils acting in their municipal capacity, show that the receipts (exclusive of borrowed moneys and of sums carried to the exchequer contribution accounts of county boroughs, but including transfers from such exchequer contribution accounts to other borough fund accounts) amounted to £18,640,668. Of this sum, £6,333,486 was from rates, and grants under the Agricultural Rates Act, 1896, and £5,134,573 on account of education. The expenditure (exclusive of that defrayed out of loans or charged to the exchequer contribution accounts of county boroughs) amounted to £18,179,154, including £8,841,062 spent on account of education. The principal items were tramways and light railways, municipal buildings, loan charges, police, salaries and superannuation and establishment charges, and public libraries, museums, and schools of science and art. The receipts of the borough councils in respect of tramway and light railway undertakings, excluding receipts from loans, were £4,484,234; while the expenditure was £4,096,917. The expenditure during the year by the councils acting as municipal authorities which was charged, or was intended ultimately to be charged, to loan accounts, amounted to £4,395,408; the separate headings being tramways and light railways, education, lunatic asylums, municipal buildings, bridges and ferries. public libraries, museums, &c., and police stations. The amount actually raised by loan during the year by borough councils acting as municipal authorities was £4,333,713—not including moneys borrowed under the Education (Provision of Working Balances) Act, 1903—while the repayments of principal and redemption of stock and annuities came to £1,172,546. The total amount of loans outstanding for the councils acting as municipal authorities (including loan debt transferred under the Education Act, 1902, and sums borrowed under the Education Act, 1903) was £55,196,737. Of this big total, the tramways and light railways are responsible for £19,496,463, and education for £17,414,137. The sums standing to the credit of sinking funds, loan funds, and redemption funds in connection with the outstanding loans amounted at the close of the year under review to £2,560,582.

The most generally interesting particulars, however, are those which deal with the accounts of borough councils acting as urban sanitary authorities, under the Burial Acts, as harbour, pier, or dock, &c., authorities, and as port sanitary authorities. The financial transactions coming within this section are of much greater magnitude than those which are embraced under the heading already referred to; and gas, water, and electric lighting works are included. The report remarks that in estimating the effect of the transactions recorded on the local taxation of the year, "it should be borne in mind that, though a considerable portion of the expenditure was defrayed out of the public rates for the purposes of public health and sanitary improvements, a large portion was to a greater or less extent reproductive, having been incurred in respect of undertakings which in some instances were wholly or partly self-supporting, and in others, besides paying their expenses, operated towards a reduction of the rates. The most important of these undertakings are water-works, gas-works, electric lighting, and harbours, piers, docks, &c." The receipts (excluding the loans) of the borough councils, acting otherwise than as municipal authorities, amounted to £27,392,851. Of this, £10,959,028 was received from rates, £6,221,602 from gas-works, £3,623,164 from water-works, and £1,978,234 from electric lighting undertakings—excluding charges for gas, water, or electric current supplied for trade purposes, and sums transferred from other accounts to meet deficiencies in revenue. The expenditure in the accounts under review (excluding that defrayed out of loans) was £27,401,086. Some of the items which went to make up this large amount were: Gas-works, £5,693,004; water-works, £3,732,809; electric lighting (including loan charges, which cannot in this case be distinguished from other loan charges, but no other expenditure on account of public electric lighting), £1,890,213; sewerage and sewage disposal, £2,016,532; and public lighting (including expenditure on public electric lighting not represented by loan charges), £1,089,268. The charges that were met out of revenue on account of loans were as follows: Gas-works, £1,167,842; water-works, £2,417,617; and electric lighting, £1,179,617. In addition to the above, the following sums were paid as charges in respect of capital belonging to the councils acting as municipal authorities and utilized instead of borrowing: Water-works, £936; electric lighting, £1116.

The expenditure defrayed during the year 1904-5 out of money actually borrowed by the borough councils acting as urban sanitary authorities, &c., amounted to £10,669,807, of which £491,151 was for gas-works, £2,724,660 for water-works, £1,935,056 for electric lighting (including expenditure on public electric lighting), and £1,246,800 for sewerage and sewage disposal works. The total amount of the loans raised during the year was £12,096,137, of which £822,402 was for gas-works, £3,453,369 for water-works, £2,023,023 for electric lighting, and £1,398,227 for sewerage and sewage disposal works. The sum applied to the repayment of principal and the redemption of stock or annuities during the year by the borough councils in respect of the debt on account of loans raised by, or transferred to, them for the purposes of the Public Health Acts, &c., was £3,489,618 The loans of these councils, acting otherwise than as municipal authorities, which were outstanding at the end of the year amounted to £177,047,852. Of this, £19,753,565 was for gas-works, £57,553,666 for water-works, £18,794,239 for electric lighting (including public electric lighting), £19,517,457 for sewerage and sewage disposal works. Loans outstanding in respect of gas-works, water-works, electric lighting, markets, harbours, piers, docks, and private improvement works amounted to £107,618,596, without including any sums raised for these purposes which it was not found practicable to apportion between these and other works, and which therefore appear under the heading of "Other purposes." This represents a net increase of loan debt on the undertakings referred to of £5,779,780 for the year, including the debt of the new borough—East Ham. The sums remaining in sinking funds, loan funds, and redemption funds at the end of the year 1904-5, to provide for the repayment of such portion of the outstanding loan debt as is repayable in this way, amounted to £10,494,834.

According to the 1901 census, the population of the 71 county boroughs was 9,570,523, and that of the 253 other boroughs 4,223,320; making an aggregate of 13,793,843. The total rateable value of land and other property was £69,386,320. The average borough rate of the county boroughs was 2s. 7·7d. in the pound, and of other boroughs 1s. 4·8d.; while the average general district rate of the county boroughs was 3s. 2·1d. in the pound, and of the other boroughs 3s. 2·6d.

Another table in the Blue-Book deals with the results of municipal trading, inasmuch as it gives such particulars as were furnished in the returns received by the Local Government Board relative to (1) transfers made by borough councils during the year from the accounts of their tramway, light railway, water, gas, electric lighting, harbour, and certain other undertakings in aid of rates; and (2) the transfers made by such councils from borough, district, or other funds to meet deficiencies in the revenues of undertakings of the same class. The transfers in aid of the rates were: From tramways and light railways, £209,444; water-works, £104,633; gas-works, £488,590; electric lighting works, £64,704; other undertakings, £31,371. The transfers to make up deficiencies in revenue were: From tramways and light railways, £36,383; water-works, £153,998; gas-works, £2380; electric lighting works, £38,617; other undertakings, £11,094. The total amount transferred by the boroughs in aid of the rates was £898,742; while the amounts transferred from rates to make up deficiencies in revenue came to £242,472.

Of the gas-works profits thus transferred in aid of rates, the amounts over £10,000 were: Birmingham, £50,677; Blackpool, £15,762; Bolton, £22,068; Burnley, £11,078; Leeds, £15,977; Leicester, £47,008; Manchester, £60,000; Nottingham, £28,300; Rochdale, £24,826; Salford, £23,630; Stockport, £12,449; Warrington, £10,330; Wigan, £13,000; and Southport, £11,250. Of the electric light works, Liverpool (£16,934) was the only instance in which a profit of over £10,000 was realized. Among water-works, also, there was only one case in which this amount was exceeded—Leeds, with a profit of £11,683, though Bolton was very near the line with £9800. Turning to the less fortunate instances in which sums had to be transferred to make up deficiencies in revenue, gas-works only figure twice—Morecambe (£1699) and Sandwich £681); but in the case of Wenlock, it is stated that the gas and water loan repayments were charged direct to the district fund. On the other hand, the list includes thirty-eight electric lighting undertakings, though in only twelve cases is the amount over £1000. In regard to losses on water-works, Birmingham, owing, of course, to its peculiar circumstances, easily leads the list with £45,000; but Huddersfield figures at £12,422, Cardiff at £12,795, and Swansea at £15,794.

As already mentioned, the accounts of the urban district councils will be noticed in another article.

Sulphate of Ammonia for Lawn Dressing.

A correspondent sends us the following recipe, taken from "Gardening Illustrated," for a useful composition for dressing lawns. It was given by the owner of the finest lawns in Leicestershire: "Sulphate of ammonia, one part; common salt, three parts; fine sand, six parts—to be scattered lightly on the grass from time to time. This application of common salt commends itself to me, as some of the finest grass I have seen is on lands which are covered by spring tides. I have used salt with advantage on my own lawns, but I have never seen it recommended before; and one of the largest sellers of lawn seed almost scoffed at the suggestion. This lawn dressing is not put forward as a weed killer, but just as a dressing to produce the finest and best turf for lawns." The correspondent who sent the preceding extract said a lady who uses the recipe speaks very highly of it; and she showed him one of her lawns which was in remarkably good condition. He was told that it was most important that the dressing should be applied in showery weather.

At the last monthly meeting of the Morecambe Town Council, the Mayor (Mr. S. Wright) took the opportuuity of wishing Mr. J. R. Duff, who, as already announced in the "JOURNAL," has relinquished the position of Gas Engineer to go to Banbury, every success in his new appointment. Mr. Duff expressed his thanks to the Mayor and the members of the Council for their kindness. The seal was then affixed to the document appointing as Mr. Duff's successor Mr. H. Blakey, of York, who has agreed to remain at least two years at Morecambe. Before going to York, Mr. Blakey was with Mr. A. J. Hope, at the Nelson Gas-Works.

EXPERIENCES WITH GAS-ENGINE BREAKDOWNS.

A NEVER-FAILING source of interest is the annual report of the Chief Engineer of the British Engine, Boiler, and Electrical Insurance Company, Limited (Mr. Michael Longridge, M.A., M.Inst.C.E.); for in it we get a year's experiences of, among other things, gas-engine breakdowns and their causes, known or suspected. The incidents and experiences Mr. Longridge collects are contributed in a manner not pleasant to the owners of the machinery; but they are not the less informative and helpful. The misfortunes of the owners are of future benefit not only to themselves, but to others; and in this is their reward for their sufferings and inconvenience.

As in 1905, the rate of breakdowns among steam-engines in 1906 was unusually high—viz., 1 in 8·1 of the engines insured. Among gas and oil engines, the rate was lower—viz., 1 in 12·4. For this difference, there are several good reasons, the principal of which are: (1) Gas-engines have fewer parts than steam-engines; (2) these parts are on the average much smaller than the parts of steam-engines of the class which are insured; (3) gas-engines cannot be habitually subjected to stresses much heavier than the parts were designed to bear.

The proportions in which the various parts of the insured gas-engines that broke down in 1906 caused or initiated the breakdowns, are given in the last columns of the following table. The other columns give the percentages for 1905 and 23 years before.

GAS AND OIL ENGINES.

Description of Parts which are Believed to have Given Way First.	Average previous to 1905.	During 1905.	During 1906.
	Per cent.	Per cent.	Per cent.
Valves and valve gear	32·6	30·1	28·7
Cylinders and cylinder ends	16·6	15·9	16·7
Pistons	11·9	6·2	6·5
Connecting rods and their bolts	11·2	10·6	12·0
Main shafts	4·5	15·9	15·7
Governors and governor gear	4·4	5·3	7·4
Silencing-boxes and exhaust-pipes	4·3	5·3	2·8
Fly-wheels and driving-drums	4·3	3·5	4·6
Clutches and couplings	3·7	0·0	0·0
Frames and pedestals	2·8	2·7	0·0
Bolts*	2·7	0·9	0·9
Total—wrecks, cause not ascertained.	1·0	0·0	1·9
Main driving ropes or belts	0·0	0·9	1·9
Starting gear	0·0	1·8	0·0
Gas-producer plants	0·0	0·9	0·9
	100·0	100·0	100·0

* These do not include bolts on pistons, connecting rods, valve gear, and other moving parts; the bolts in these parts being included with the parts themselves.

The causes of these breakdowns may be roughly classified as under:—

	Gas and Oil Engines. Per Cent.
Accident or causes unascertained	34
Old defects or deterioration by wear and tear	23
Weakness, bad design, workmanship, or material	24
Negligence of owners or attendants	19
	100

Some of the breakdowns enumerated above are described by Mr. Longridge; and, in making his selection, it is apparent that he has, as far as possible, proceeded on the lines of placing on record all unusual occurrences or types of constantly-recurring sequences of cause and effect. The very first example is a somewhat peculiar one. Here we have a horizontal gas-engine, with cylinder 6½ inches diameter by 13-inch stroke, running at 165 revolutions per minute, with town gas. The water for cooling the jacket was supplied from tanks through a pipe provided with a stop-cock, and returned to the tanks through another pipe, entering one of them near the water-level. The tanks were placed where they could receive rain water from the roof of the works. Intending to be absent for two days during the frosty weather in December, the owner drained the jacket, locked up the place, and left the engine, as he thought, safe. After his departure, a heavy shower came on, which filled the tank above the mouth of the return-pipe from the jacket, and so filled the latter with water. After the shower came a frost, which froze the water and forced a piece out of the jacket about 6½ in. by 5 in. which the owner found when he returned to re-open his works. The drainage of water-jackets in cold weather is very necessary. Every frost brings in a number of claims for broken cylinders, although the Company sends out many circulars at the beginning of every winter warning insurers either to keep their gas-engines warm at night and week-ends or to empty the water-jackets and connected pipes. Another notable occurrence, was in the case of a horizontal gas-engine, with cyliuder 17 inches diameter by 24-inch stroke, running at 160 revolutions per minute, with Dowson gas. The power, varying from 30 to 70 indicated horse power, was transmitted by a belt running on a pulley 6 feet diameter, keyed on the over-hanging end of the crank-shaft outside one of the two fly-wheels. The pulley was made in halves, with a cast-iron boss, having a flange 15 inches diameter and 2 inches thick on each side, and had 44 wrought-iron or steel arms 1 inch diameter screwed 22 into each flange, and a wrought-iron rim 2 feet wide and $\frac{3}{16}$ inch thick. The engine was put to work in 1904, and usually ran from 6 a.m. to 5 p.m. daily. One morning about 8.15 a.m., when driving the shafting only, the belt-drum suddenly collapsed. Forty of the arms snapped off close to or just inside the boss, and the other four were bent. Three of the broken arms appeared to have been broken for some time; but the fractured surfaces in the rest were fresh. No cause could be assigned; but the inspector who examined the wreck stated that the arms were very brittle, and suggested that the brittleness might be due to long-continued vibration set up by the impulses communicated to the drum by each explosion in the cylinder. That this would have the effect of breaking the arms through the screw-threads in the boss, is probable enough; but it is curious that this effect should have been produced practically simultaneously in 37 out of the 44 arms.

The breakages of crank-shafts in 1906 were fewer than in 1905, although the number of gas-engines insured was greater. The decrease is no doubt due to the larger diameters which many makers of gas-engines have adopted during the last two or three years. If all would follow this good example, the breakages would be fewer still. Shafts which might have been strong enough five years ago are insufficient for the higher compressions and heavier fly-wheels now in use; while shafts which were too weak for the old conditions are still more inadequate to-day. Calculations of the stresses upon the shafts of gas-engines are so difficult and uncertain as to be practically impossible, and makers have to rely to a very large extent on experience, which can only be gained slowly and at considerable expense.

The practice seems to be to make the shafts, and particularly the crank-pins, of small engines relatively stronger than those of large. But the general tendency is to increase shaft diameters. Nevertheless, weak shafts are still being made. In the keen competition for business the makers of these shafts gain an unfair advantage; for the buyer of a gas-engine, particularly a small one, has seldom the faintest idea whether the shaft supplied to him is strong or weak. Of the shafts that broke in 1906, 77 per cent. had two bearings, 23 per cent. had three or more bearings. Of the shafts with two bearings, 53 per cent. had one fly-wheel, and 47 per cent. had two fly-wheels. Of the shafts with two fly-wheels, one broke in one of the crank-arms, and one in the body close to the skew-wheel for driving the side shaft. The rest broke in one of the necks, usually the neck at the end that carried the driving-pulley. Of the shafts with one fly-wheel, two broke in the crank-pin; the rest in the neck between the crank and the fly-wheel. The shafts with three bearings all broke in the neck between the crank and the fly-wheel. The breakage of the shaft of the two fly-wheel engine close to the skew-wheel was unusual. The engine was six years old. It had a cylinder 6¼ inches diameter by 12-inch stroke, and ran at 160 revolutions per minute with town gas. The shaft was steel, 2¼ inches diameter, with two bearings, each 6 inches long. The skew-wheel was fixed close to the end of the left-hand bearing, and just beyond it was one of the fly-wheels. The other fly-wheel and driving-pulley were at the other end of the shaft. The left-hand end of the shaft, with its fly-wheel, dropped off and careered across the engine-room, and the skew-gear was broken. The fracture occurred close to the edge of the skew-wheel and between it and the fly-wheel. It was at right angles to the axis of the shaft, and partly old. Apparently it had started with a skin crack produced by a scriber or by pressure of the sharp edge of the skew-wheel, and had then extended across the shaft.

A case that may be described as unusual is a horizontal gas-engine, with cylinder 11⅝ inches diameter by 20-inch stroke, running at 180 revolutions per minute with suction gas. Soon after starting one morning, the attendant noticed the cap of one of the main bearings wriggling and one of the fly-wheels wobbling. He came to the conclusion that the shaft was bent, and sent for the makers, who took it to their works, straightened it, re-turned it, and replaced it in its bearings. On starting the engine, the shaft was again found to be bent, and was sent back to the maker's works the second time. Here one of the Company's inspectors examined it. He found it bent about $\frac{1}{8}$ inch, and noticed a mark like a fine crack at the junction of the right-hand neck with the crank. A few blows with a hammer convinced him that the shaft was cracked. He therefore had it taken out of the lathe, and broken with a sledge hammer. The cause of the bending then became apparent—viz., a crack extending through a large proportion of the cross-section of the shaft. The cause of the crack also became clear—a sharp corner at the junction of the neck with the crank web. This sharp corner had probably been cut by the turner by mistake; and somebody, to cover it up and avoid scrapping the shaft, had shrunk on a collar, and turned it to form a fillet. The shaft would have been weak even with a proper fillet; but its weakness was, of course, increased by the abrupt change of section covered by the false fillet. Its short life of about 32 million revolutions is thus accounted for.

In some other cases particulars believed to be fairly accurate of the lives of shafts were obtained. They are given next page. As regards these figures, it is right to observe generally, that the numbers of explosions per minute are only the averages of the numbers counted by the inspectors at their periodical visits, and are therefore only approximately correct; and, particularly, as regards No. 2 that the fillets at the ends of the necks were very

—	Diameter of Cylinder.	Stroke of Piston.	Revolutions per Minute.	Explosions per Minute, Average.	Number of Bearings.	Number of Fly-wheels.	Life of shaft in Millions of Revolutions.
1	8¾	15	182	63	2	1	31
2	12	20	172	48	2	2	150
3	20	30	180	49	3	1	83
4	15½	23	184	—	3	1	15
5	8¾	15	190	41	2	1	92
6	16½	20	160	31	2	2	104
7	7¾	14	200	74	2	2	348
8	10	20	180	49	2	2	135
9	16	21	162	—	3	1	259
10	5	9	230	48	2	1	149
11	10	18	205	46	2	2	235
12	13½	20	175	32	2	2	181

small, No. 9 that the foundation was very unsteady and the bearings probably out of line and level, and No. 10 that this was the third shaft broken. A fourth gave way in March this year, after making 45 million revolutions. All broke in the crank-pin, which is not astonishing considering its weakness. The breakage of No. 3 after so short a life as 83 million revolutions is difficult to account for, except on the assumption that the third bearing had got out of line or level, and thus caused excessive stress on the neck which broke.

(To be continued.)

GAS-WORKS ACCIDENT FUNDS.

South Metropolitan and South Suburban Schemes.

When noticing in the "Journal" for Dec. 25 last the lates issued report of Mr. J. D. Stuart Sim, the Chief Registrar of Friendly Societies, with regard to mutual schemes between employers and employed for securing to the latter the benefits (or more than the benefits) provided by the Workmen's Compensation Act, it was pointed out that only two Gas Companies were included among those concerns that had in this way "contracted out" of the Act. These were the South Metropolitan and South Suburban Gas Companies; and in the belief that they will prove of interest to others engaged in the gas industry, we now publish the rules as revised to comply with the new Compensation Act. These, it may be mentioned, have, as required, been certified by the Registrar of Friendly Societies, to remain in operation (if not further renewed) until June 30, 1913. There are also included the rules of the "Jury" system of inquiry into accidents, which have been somewhat altered and improved. This system has been a great success with the two Companies.

Writing on the subject, Sir George Livesey says: "In order to make it quite certain to all the workmen that their subscription could not relieve the Companies of any portion of their responsibility under the Act, it was made almost nominal. But a novelty has been introduced in Rule VII. whereby the subscription is graduated according to the number of accidents. This is just, and will, I hope, tend to reduce the number of accidents. I can explain the justice in this way. Suppose 1000 men pay 1s. a year apiece (= £50); and suppose there are 50 accidents costing an average of about £8 each, or £400. The workmen's subscription is only 12½ per cent. of the total cost; and as the benefits obtained under the scheme are quite 25 per cent. greater on the whole than those given by the Act, the workmen's subscription clearly is not a relief to the Companies. But, to put an extreme case, suppose there are only five accidents in the year costing £40, then the workmen's subscription more than pays the total cost. The proviso in Rule VII. meets the difficulty. If the accidents are at the rate of 55 or more per 1000 men, the subscription will be 1d. a month; if accidents are at the rate of 40 and under 55, the subscription will be 1d. for two months; and if under 40, 1d. a quarter. Each station of the South Metropolitan Gas Company will be treated separately; and every half year a notice will be put up, giving the particulars of all the stations and the rate of subscription for the next half year. This time two are 1d. a month, two 1d. two months, and three 1d. a quarter. But it will be said, Why trouble about a subscription at all, seeing it is so small? The answer is that we are a co-partnership, and we want to enlist, in all our dealings with the men, their co-operation, and especially in the prevention of accidents. Moreover, their subscription, however small, brings them in a sharing in the responsibility and in the management of the fund. The Company have gained in four ways—(1) the promotion of goodwill, (2) the reduction in the number of accidents, (3) a money saving, and (4) the prevention of litigation. The cost has been brought down to about 5s. per cent. on wages, with considerably more liberal payments than the Act required. Under the new Act, it will be increased to not more than 7s. per cent. to the Company."

The rules of the two Companies are practically the same; and we give those of the South Metropolitan Company, on the first page of which appears the following statement, signed by Sir George Livesey: Prevention is the chief object. "Prevention is better than cure." How poor a substitute for prevention is money compensation. The Directors hope, with the hearty co-operation of all officers and workmen, to reduce accidents to the smallest possible number. All are requested to exercise all possible care and forethought, and to report, without loss of time, any defects in plant or appliances to the foreman in charge of the work or to the engineer of the station. The Directors thankfully acknowledge this co-operation in the past; for since this scheme was started in 1897, the proportion of accidents per 1000 subscribers to the fund has been greatly reduced, as is proved by the following figures:—

1898—82 per 1000	1901—64 per 1000	1904—50 per 1000
1899—76 do.	1902—52 do.	1905—44 do.
1900—71 do.	1903—56 do.	1906—37 do.

Note.—These figures include all accidents that incapacitated for three days. Rather over half the accidents are slight, incapacitating for less than a fortnight.

The benefits of the fund beyond those of the Workmen's Compensation Act are: (1) Free medical and surgical attention. (2) The accident pay averages 1s. 6d. a week more. (3) The Act gives nothing for the first week for accidents disabling for less than a fortnight; the fund gives 18s. from the date of the accident in all cases. (4) The allowance to widows on the average exceeds the provisions of the Act. The workmen's subscriptions only partially meet these extra benefits.

SOUTH METROPOLITAN ACCIDENT FUND.

When an accident happens, everything, as far as possible, is to be left untouched. The foreman is at once to be informed; and, if a serious accident, also the engineer of the station.

Rules.

I.—*Name.*

This fund shall be called the "South Metropolitan Gas Company's Accident Fund."

II.—*Object.*

First, the prevention of accidents. Secondly, this fund is established by mutual agreement between the Company and their workmen as a substitute for the Employers' Liability Act, 1880, and the Workmen's Compensation Act, 1906. To give prompt and certain compensation to workmen for loss by reason of accidents, incapacitating for not less than three days, occurring to them in the course of their employment in the service of the Company. They will be admitted to the benefits of this fund, subject to the conditions specified in the following rules. This fund relieves the Sick Fund from all charges for accidents.

III.—*Membership.*

All men in receipt of weekly wages employed by the Company, including all odd or casual men, are invited to contribute to the fund, and accept the benefits which it provides in case of accident, in lieu of any claim which they, or their representatives, might otherwise have had against the Company under the Acts named. The payment of the subscription shall constitute acceptance of the conditions, and shall entitle to the benefits of the fund, and shall be deemed a contract within the provisions of section 3, sub-section 1, of the Workmen's Compensation Act, 1906.

IV.—*Withdrawal from Fund.*

Any member wishing to withdraw from the fund may at any time (except after an accident, and during the time he is entitled to accident pay) give a month's notice, and at the expiration of the month shall cease to be a member.

V.—*Committee of Administration.*

The fund shall be administered by the Co-Partnership Committee.* The Honorary Secretary of the Co-Partnership Committee shall act as Secretary to the fund.

VI.—*Auditors.*

The Co-Partnership Auditors shall audit the accounts, which shall be kept by the Company's officers at the Company's expense; and all money shall be in charge of the Company.

VII.—*Income—How Raised.*

Workmen's Contributions.—To encourage the desire to prevent accidents, the contributions of the workmen shall vary according to the number of accidents. For this purpose, each station shall be treated separately; the contribution for the half year at each station varying according to the number of accidents at the station in the preceding half year. When the accidents in any half year at any station are at the rate per annum of 55 or more per 1000 men employed, every man at that station in receipt of weekly wages (including men casually employed) who joins the fund, shall pay in advance 1d. a month for the next half year. When the accidents are at the rate of 40 and under 55 per 1000 men per annum, the subscription shall be at the rate of 1d. for two months. When the accidents fall below the rate of 40 per 1000 men, the subscription shall be at the rate of 1d. a quarter. Youths under 18 years of age and women shall pay half the above subscription, and receive half the benefits of ordinary members. These contributions will be entirely devoted towards the payment of free medical and surgical attendance.

Company's Guarantee.—The Company guarantee the financial stability of the fund, and will subscribe the necessary amount quarterly to make income balance expenditure, and further guarantee at the expiration of the scheme a due provision for the allowances payable to the then existing incumbents.

VIII.—*Benefits.*

The benefits to members must, on the whole, exceed those obtainable by the Act to the extent of their contributions to the fund.

* The Co-Partnership Committee consists of 36 members, of whom 18 are workmen elected by ballot and 18 other members elected by the Board of Directors, of whom one is the Chairman, who is also Chairman of the Co-Partnership Committee.

Members.—Non-Fatal Accidents.—The allowances, with free medical attendance, shall be at the following rates:—

(*a.*) Accidents disabling for not less than three days shall entitle members to benefit at the rate of 18s. a week from the date of the accident. Payment to be continued until recovery, or until the doctor certifies that the man is fit for work, or until he is proved to be permanently incapacitated. In all cases, on recovery, if able, injured men will return to their usual work at the same wages; but if partially disabled, other work will be found for them at not less than 24s. a week, if the wages exceeded that amount.

(*b.*) If it is proved that the injury to a workman is attributable to the serious and wilful misconduct of that workman, any compensation claimed in respect of that injury shall, unless the injury results in death or serious and permanent disablement, be disallowed. To men injured by their own "serious and wilful misconduct" the Company give no undertaking as to future employment.

Non-Members.—Those workmen, whether regular or odd men, who do not subscribe to the fund will, in consideration of the Company's contribution thereto, be paid from the fund what they may be entitled to under the Workman's Compensation Act, 1906, without medical attendance, and with no undertaking by the Company to find employment on recovery.

IX.—*Permanent Disablement.*

In cases of permanent incapacity to do any work, the Co-Partnership Committee shall decide what permanent weekly allowance or lump sum shall be paid in addition to any pension from the Superannuation Fund to which the injured man may be entitled; but the total shall not be less than he could have obtained under the Act of 1906.

X.—*Fatal Accidents.*

In the case of a fatal accident, £12 funeral money shall be paid to the widow or dependants from the Accident Fund. The widow shall be granted a pension while leading a respectable life, or until re-marriage, when a sum not exceeding £10 shall be paid her. Such pension to be in all cases £1 a week for at least the first three months. At any time after the three months, the pension may be reduced gradually, or at once, as the Co-Partnership Committee may determine, to the following scale:—

Widows without children, 10s. a week.
For each child not exceeding five in number, under 14 years of age, 2s. a week.
The total payment not to exceed 20s. a week.

If the deceased man was a widower leaving children dependent, or if he leaves other dependants wholly, or in part, dependent upon his earnings, the Co-Partnership Committee shall decide what allowance shall be made, which shall be in excess of the amount obtainable under the Act, but shall in no case exceed what would have been given had there been a widow with children. If he leaves no dependants, the reasonable expenses of his medical attendance and burial, not exceeding £10, shall be paid from the fund.

NOTE.—In 1907, *the wages paid averaged* 33*s.* 1*d. per week for all wage-earners in constant employment* (30*s.* 6*d. in the case of the South Suburban Company*).

XI.—*Three Days' Disablement.*

No claim shall be made on the fund for less than three working days' disablement.

XII.—*Notice of Accident.*

Every workman intending to claim on the fund must give notice, personally or in writing, to the engineer of the station as soon as possible, or at the outside within three days after the occurrence of the accident. In case of further delay, the Committee shall have the option of dating the payment of allowance from such time as they consider fair.

XIII.—*Medical Examination.*

The certificate of any qualified medical man that the claimant is unable to work by reason of some injury, will, when accompanied by a form of application, be accepted by the Committee. But immediately any claim is formally made, the claimant must undergo examination by the doctor appointed by the Committee on receipt of an order from the authorized officer at the station. Anyone refusing to comply with such order shall have his allowance stopped pending the consideration of the case by the Committee. In cases of doubt or uncertainty, a consultation with another of the Company's doctors shall take place.

XIV.—*Behaviour while in Receipt of Weekly Allowance.*

Every person in receipt of weekly allowance must be under qualified medical attendance during the whole of the time he is receiving such allowance; and if his medical attendant or fund doctor, or the visitor, or any member of the fund shall report to the authorized officer at the station neglect of ordinary precautions—such as being out of doors after 7 p.m. in the winter and 9 p.m. in the summer, use of intoxicants against doctor's orders, or if the injured person do anything to retard his recovery, or fail to go to work when able to do so, the further payment of allowance, either wholly or partially, shall be stopped, subject to appeal by the injured workman to the Co-Partnership Committee.

XV.—*Persons leaving Home.*

Any person receiving a weekly allowance who may desire to leave home for change of air, &c., must inform the authorized officer at the station of his intention of doing so. Such officer shall then cause him to be examined by the fund doctor, who will decide whether such change is desirable or not.

XVI.—*Weekly Medical Certificate.*

Injured persons receiving weekly allowance, who are living at a distance beyond the supervision of the examining doctor, must supply the authorized officer at the station, not later than Thursday of each week, with a medical certificate of their inability to work.

XVII.—*Allowance—To whom Paid in Case of Death.*

No allowance will be paid until clear legal proof has been supplied to the Co-Partnership Committee that the claimant is the widow, or children, or dependant of the deceased.

XVIII—*Conditions under which Accident Allowance will be Paid.*

Before any allowance can be granted for any accident, it must be proved that it occurred while the workman was in the employ, and actually engaged in, the work or business of the Company. In case of death, or permanent disablement, the Co-Partnership Committee shall decide what allowance shall be made, in accordance with the rules.

XIX.—*Declaring off Fund.*

Every person resuming work, after being in receipt of weekly allowance, must report the same, at once, to the Secretary or authorized officer at the station.

XX.—*Annual Balance-Sheet.*

A balance-sheet and statement of accounts, with the number of accidents in the past year, shall be prepared every February, and posted in prominent positions at the works; and when desirable a meeting of the workmen will be held for the consideration of the same.

XXI.—*Extras.*

When the Co-Partnership Committee shall consider that the interests of an injured man will be thereby served, they shall have power to grant extras—such as a sum of money to enable him to go into the country, or to a convalescent home, or for a surgical appliance.

XXII.—*Juries of Workmen.*

The system of an inquiry into accidents by a jury of twelve workmen, shall be continued in accordance with the following regulations:—

1.—An inquiry shall be made within the first fortnight, if possible, into every accident that is a charge on the fund.

2.—At the discretion of the engineer, an inquiry may be made into any accident that is not a charge on the fund or that results in loss of, or damage to, property only.

3.—That such inquiries be made by a jury consisting of twelve workmen presided over by the engineer of the station, except in fatal cases, when the Chairman, or one of the Directors of the Company, shall preside; and in these cases the inquiry shall be subsequent to the Coroner's inquest.

4.—In order to secure a fair selection of jurymen, an alphabetical list shall be made in the month of May every year at each station of all the men who have been three years in the Company's service; and in selecting a jury, the names shall be taken in the order in which they appear on the list. Every jury shall consist of not more than two members of the Co-Partnership Committee of the station, not more than four from the department in which the accident happened, and the remainder taken in order from the jury list—men required as witnesses are not to serve on the jury. Any man, excepting the members of the Co-Partnership Committee, having served on a jury, shall not again serve until the whole of the names on the list have been called in their turn.

5.—The jury and the presiding officer shall call witnesses and hear evidence, and thoroughly investigate all the conditions and circumstances connected with the accident. The jury shall then retire alone to consider, and endeavour to agree upon, a verdict.

6.—To prevent a similar accident, the jury shall endeavour, to the best of their ability, to arrive at the real cause of the accident, and, when they have done so, shall state their honest conviction, not hesitating to say whether any blame attaches to any official or workman, or whether the plant, machinery, or means of protection were defective, if they are satisfied that there has been any neglect, or carelessness, or defect.

7.—The jury shall determine whether it was a pure accident, or who or what was the cause, or whether it was due to serious and wilful misconduct. These points whenever there is any doubt, shall be decided by ballot, and by a two-thirds majority; the twelve jurymen alone voting. On these points, either the injured workman or the engineer of the station is to have a right of appeal to the Chairman of the Company, whose decision shall be final.

8.—If, in the opinion of the jury, anything can be done to prevent a similar accident in future, they shall make such recommendation as they may consider necessary.

9.—The inquiry shall take place in public—that is in the presence of as many of the workmen as can conveniently attend without unduly interfering with their work; and, where practicable, the inquiry shall be held on the spot where the accident happened.

10.—The verdict of the jury shall be posted up in one or more conspicuous places about the works; and particulars, with a summary of the case and the proceedings thereon, with the verdict, and the names of the jurymen, shall be recorded in a book kept for the purpose. A copy of this summary shall also be sent to the Secretary of the Company, to be laid before the Directors.

Note.—The followiug questions are submitted as a guide to the jury, to which they may add any remarks they may consider necessary.

Questions.

1.—Was the accident caused by any defect in the plant or materials used; and, if so, say what it was?

2.—Was there any mistake in the manner in which the work was done; and, if so, state it?

3.—Was the accident due to the negligence or want of care or foresight of any officer or foreman; and, if so, let the truth be known?

4.—Was the accident caused wholly or in part by any carelessness or negligence of the injured man, or by that of any of his fellow workmen; and, if so, let the truth be known?

5.—Was the accident attributable to the serious and wilful misconduct of the injured man or any other person?

6.—Was it a pure accident, for which no defect in plant and no one was to blame?

7.—Can anything be done to prevent a similar accident?

The prevention of accidents is the chief object. Therefore to give honest and true answers is a duty; and it will do a kindness to all concerned, and will not penalize anyone except on Question 5. Men injured by "their own serious and wilful misconduct" get no compensation except in case of death.

XXIII.—*Notice to Close Fund.*

Six months' notice from the Company or workmen shall terminate the existence of this fund.

XXIV.—*Alteration of Rules.*

Notice of any proposed increase or decrease in the amount of contributions, or an alteration of the scale of allowances, or any alteration or addition to these rules, shall be posted at all the works of the Company for fourteen days, and meetings of workmen will be held for an expression of opinion upon the same. If approved by a two-thirds majority, the alterations or additions shall be incorporated in the rules, subject to the consent of the Registrar of Friendly Societies; but no alteration shall be made which would render the scheme less favourable to the workmen than the provisions of the Act.

XXV.—*Ambiguous Rules.*

In all cases when the meaning of a rule is disputed, the decision of the Co-Partnership Committee shall be final, and without appeal.

COMPARATIVE COST OF GAS AND ELECTRICITY.

By J. Duncan, M.A., LL.B., Barrister-at-Law.

The competition of electric lighting companies with gas companies for the patronage of their consumers is becoming so keen that undue preferences are offered in some instances, contrary to section 20 of the Electric Lighting Act, 1882. A difficulty in detecting these preferences stands in the way in some cases by reason of the ingenious forms in which the abatements are offered. For example, a compauy will have as their printed price for lighting 7d. and 3d., or a flat-rate of 6d., while gas consumers are offered all sorts of prices, such as "15 per cent. less than your gas bill." It is not clear, on the face of this offer, whether or not this is an undue preference given to gas consumers over those who do not burn gas. The section reads—

The undertakers shall not, in making any agreements for a supply of electricity, show any undue preference to any local authority, company, or person; but, save as aforesaid, they may make such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by or, in pursuance of, the Licence, Order, or Special Act authorizing them to supply electricity.

In order to afford a basis of comparison, it is necessary to reduce the prices of gas and electricity to a common denominator—say the cost per hour or, better, the cost per ten hours. For example, the cost of 16-candle power gas at 3s. per 1000 cubic feet and electricity at 6d. per unit can be compared by ascertaining the time that a unit of either illuminant will last. The comparison can be extended to other prices, and the whole arranged in the form of a table. In the same way, other tables can be elaborated for 15 and 14 candle power gas; the compilation forming a ready reckoner for gas managers who have to withstand the illegitimate competition of electric companies.

The following calculations are based on the estimate that 5 cubic feet of gas per hour are required to produce a light of 16-candle power, and that the Board of Trade unit of electrical energy—viz., 1000 watt-hours—will give 16-candle power of electric light for 17½ hours.

Gas. Price per 1000 Cubic Feet.	Cost per Ten Hours.	*Electricity.* Price per 1000 Watt-Hours.	Cost per Ten Hours.
1s. 0d.	0·6d.	1d.	0·571d.
2 0	1·2	2	1·142
2 6	1·5	3	1·715
3 0	1·8	4	2·285
3 6	2·1	5	2·855
4 0	2·4	6	3·430
5 0	3·0	7	4·000
6 0	3·6	8	4·570
7 0	4·2	9	5·140
		10	5·710
		11	6·300
		12	6·860

Thus it will be observed that at the prices of 3s. for gas and 6d. for electricity there is a saving of 1·63d., or about 1½d., per ten hours. Assuming an average use of light for four hours a day, there would be a saving of 18s. 3d. per year for each light, or £3 13s. for four burners—a fair estimate for a tradesman's household. If worked out to decimals, the saving would have been £3 19s. 7d. This can be shown by a comparison of the total bills for the year in the above example. The electric bill would be for 334 units, or £8 7s.; the gas bill for 29,200 cubic feet, or £4 7s. 5d.—showing a difference of £3 19s. 7d. A 15 per cent. discount offered in the case cited would represent a further 13s., or £4 12s. 7d. for each similar household paying the printed flat-rate of 6d. In a town of 10,000 consumers, the undue preferences would represent upwards of £45,000, which the sole users of electricity would be entitled to get back every year from the electric company. This amount is, perhaps, not wonderful, seeing that a well-known Oil Company in America has lately been fined £6,000,000 for allowing illegal rebates, which are of the same nature as undue preferences.

The foregoing table is calculated upon the yield of the old flat-flame burner. A comparison with the incandescent mantle, of course, shows still greater economy in favour of gas lighting. By substituting the incandescent mantle for the flat-flame burner, the cost of the gas will be reduced to $\frac{1}{8}$th (strictly 1-7·8th), and in extreme instances to $\frac{1}{5}\frac{1}{5}$th in the case of the best, and $\frac{1}{8}\frac{1}{8}$th in the case of the worst, flat-flame burners. The data upon which these calculations are based are to be found in one of the Cantor Lectures delivered by Professor Lewes at the Society of Arts towards the close of 1902, and published in the "Journal" at the time. The following are the figures given by Professor Lewes as showing in candle-units the light emitted per cubic foot of 16-candle gas consumed:—

Burner.	Candle-Units.
(1) Incandescent, high pressure	30 to 35
(2) ,, Kern	20 ,, 25
(3) ,, ordinary	14 ,, 19
(4) Regenerative	7 ,, 10
(5) Standard argand	3·20
(6) Ordinary argand	2·90
(7) Flat-flame, No. 7	2·44
(8) ,, No. 6	2·15
(9) ,, No. 5	1·87
(10) ,, No. 4	1·74
(11) ,, No. 3	1·63
(12) ,, No. 2	1·22
(13) ,, No. 1	0·85
(14) ,, No. 0	0·59

The $\frac{1}{8}$th saving in cost is found by comparing the flat-flame burner No. 5 (9) with the ordinary incandescent burner (3). The extreme cases $\frac{1}{5}\frac{1}{5}$th and $\frac{1}{5}\frac{1}{5}$th are derived from comparing the flat-flame burners No. 7 (7) and No. 5 (9) with the incaudescent high-pressure burner.

Applying these figures, another table can be constructed showing the comparative cost of electric light and gaslight supplied per incandescent mantle. But, in order to make the comparison intelligible, it is necessary to increase the standard of comparison beyond the ten hours in the previous table. I have taken a standard of 1460 hours a year, so as to maintain the same comparison as in the previous references of gas consumption for four hours a day:—

Gas. Price per 1000 Cubic Feet.	Cost for One Year of 1460 Hours, 4 Burners.	*Electricity.* Price per 1000 Watt-Hours.	Cost for One Year of 1460 Hours, 4 Lamps.
1s. 0d.	3s. 7d.	1d.	£1 7 10
2 0	7 3	2	2 15 8
2 6	9 1	3	4 3 6
3 0	10 10	4	5 11 4
3 6	12 9	5	6 19 2
4 0	14 7	6	8 7 0
5 0	18 2	7	9 14 10
6 0	21 8	8	11 2 8
7 0	25 6	9	12 10 6
		10	13 18 4
		11	15 6 2
		12	16 14 0

The undue preference now appears much more than in the comparison with the flat-flame burner. The comparative costs are now 10s. 10d. per annum for gas (at 3s.) and £8 7s. for electricity (at 6d.); being a saving of £7 16s. 2d. for the selected householder or £70,883 6s. 8d. for the suggested town of 40,000 inhabitants. Another 15 per cent. as allowance would increase the total by £1500. These undue preferences are sufficiently great to break up most of the infringing electric companies, and give a respite to genuine gas competition by the incandescent system.

The Ferro-Concrete System of Reservoir Construction.

Within the last few years, many reservoirs, of all sizes and kinds, have been constructed in Great Britain in accordance with the Mouchel-Hennebique system of ferro-concrete; and as an indication of the increasing employment of this system for the purpose named, we give the following brief particulars relative to works for which contracts have recently been settled. The most important of these is the covered service reservoir designed for the borough of Poole by Mr. W. Matthews, M.Inst.C.E., of Southampton, which will be 140 feet long and 40 feet wide, and have a capacity of 520,000 gallons. At Queenborough, a circular reservoir, 30 fect in diameter and 19 feet deep, with a capacity of 120,000 gallons, is under construction from the designs of Mr. H. Small, the Engineer to the Corporation. At Bramham Park, near Leeds, an octagonal storage reservoir 18 ft. 6 in. by 4 feet, is being built for Mr. G. Lane-Fox, M.P., from the designs of Messrs. Blow and Billery, Architects, with Mr. L. G. Mouchel as Consulting Engineer. Underground reservoirs at the collieries of the Harton Coal Company, near South Shields, a service reservoir roof at Spennymoor for the Weardale and Consett Water Company, a water-tower for the Pocklington Urban District Council, and a reservoir for the North British Railway Company at St. Margaret's, are among other works of the same class for which contracts have been signed.

NOVELTIES FOR THE HEATING AND LIGHTING SEASON.

IN THE GAS-HEATING SECTION.

The whirligig of time has again brought us to the season of the year when works improvements and repairs ready for the winter's demand are finished or are approaching that state, and when the gas manager will be turning thoughts and attention to the installation in his show-rooms of some of the latest types of fires, lamps, and fittings that the manufacturers have turned out for acceptance by him and the public. The manufacturer of such appliances must ever be on the alert, and ever studying requirements, in order that he may be in the van in the matters of efficiency and suitability for varying position and purpose. Take the gas-fire for instance. Its extending popularity rests largely, it is true, on the price of gas, but, in a no inconsiderable degree too, upon heating efficiency relative to consumption, upon adaptability to position, and upon the conveniences provided for economically maintaining the fires in a good condition, without the trouble of disconnecting and removing them. With the price of gas the manufacturer of the fires has no concern other than that he knows it influences his trade; with the three latter points, he is doubly concerned, for in connection with them he has to please both the public and the very properly exacting gas manager. Thus we find, season after season, that, in one or other or in all three respects, the manufacturers give us something new appealing for consideration, and showing advance upon what has gone before.

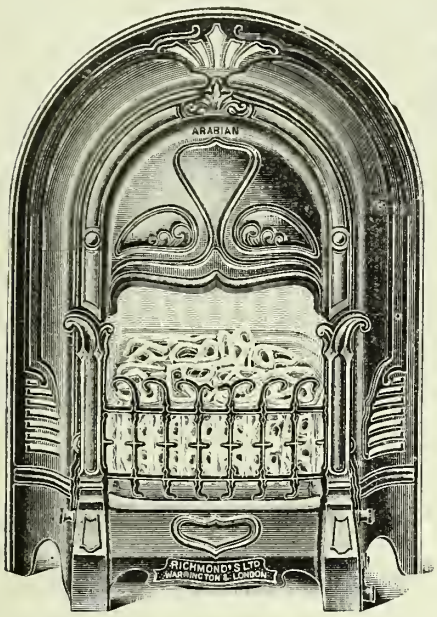
To the aid of the gas-fire makers, other minds and outside investigation are being invoked; and if there are further means by which efficiency of service can be heightened, the gas-fire maker will be as pleased to take advantage of such means as the gas manager and the public will be to enter upon the enjoyment of them. Meantime, we are not among those who try to belittle what the gas-fire manufacturers have so far given to the industry. Their productions embody the best of which they are capable, until they find out, or someone shows them, the way to something better. The present productions are of good appearance and finish, and applicable to all conditions; and heating capacity and usefulness (though, from the scientific point of view, it is not claimed that finality has been reached) are so pronounced that to decry gas-fires in these respects is to speak into deaf ears. There is an excellent business already being done in gas-fires; otherwise it would not pay the makers to devote as much time and attention as they do to this class of business. But it is not what it might be. The public wants educating; and the gas industry cannot, and must not, allow somnolency to creep into this branch. It must be pushed; aud there must be renewed interest. Now is the time for special activity. Coal is dear; and there is competition in every town from electricity at low prices to capture the business, and a new solid fuel competition is threatened. It is said that this new solid fuel competition is with coal and not with gas or coke. Let the gas manager not be misled into any comfortable indifference. To the extent that the new solid-fuel provided by fresh comers obtains patronage, to that extent the chances of gas heating must for a time be lessened. Moreover, a further inducement to greater animation in the heating branch is that in some towns the gas-cooker has spread itself with such rapidity that the numbers of cookers and gas consumers are fast nearing an equality. The field for special enterprise that offers in heating is, as was shown in our editorial columns a fortnight since, an extensive one. But to secure any large accretion of business from it, there must be a special and persistent attack; for, as Mr. Shadbolt put it in his interesting letter last week, every branch of the gas business really requires different treatment, and this one of heating more so than the others. This is a business that cannot develop or take care of itself without assistance. As in the early days of the gas-cooker, prejudice has to be broken down, and inducements offered. What man has done, that man may do. And the success that followed perseverance with the gas-cooker should, in considerable part, succeed a continuous special campaign in the heating field.

In many towns, there have in the past been objections, on the part of the gas management, to the hiring-out of gas-fires in the same way that cookers are hired-out. It has been a question for consumers of purchase of fires at cost price from the Company or Gas Department, or leave them. But that will not do now. The reasons advanced for this policy have been many; but they are all survivals of a totally different condition of things from the existing. The consumption of gas by fires was at one time high; efficiency comparatively low. Now the consumption has been reduced, by proper regulation, to something like half. The time was when a 10-inch fire would roar away, and cause the index of a meter to register with unerring regularity something like 40 cubic feet of gas an hour, until the consumer, through the excessive heating of the room, was reminded that the gas was being wasted. Nowadays 20 cubic feet an hour at 2-inch pressure will give as much satisfaction as 40 cubic feet iu the oldeu days; and the 20 cubic feet can be largely reduced on the room attaiuiug a comfortable degree of warmth. The greater consumption of bygone days led to complaint, and complaint ruffled the composure of the gas officials. Then another reason was that fires were formerly built in a manner that defied their maintenance in good condition without disconnection, removal from the consumer's premises, and their return and refixing. This involved a large amount of labour. But labour has now been brought down to an almost negligible quantity by the new methods of construction, which have made maintenance the very occasional work of but a few minutes per stove *in situ* without putting the consumer to any greater inconvenience than the presence of a workman for a time so short as to be measured by minutes, and the deprivation of the service of the fire for a similar short period. The interchangeability of parts, too, has made repair quite a light matter. Thus it is that condition has altered, and the reasons for not ardently prosecuting the heating business have been dispelled by ingenuity, and cannot now have any real existence.

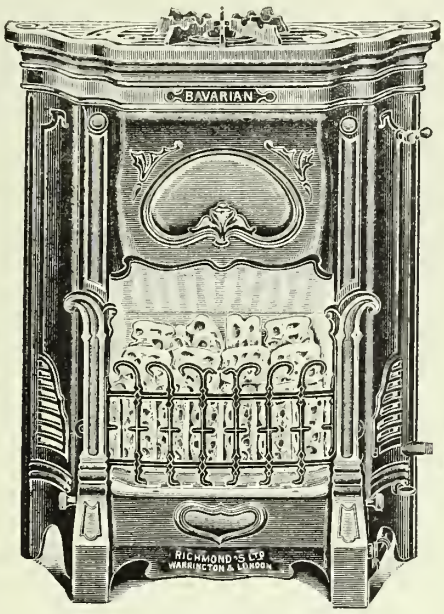
Richmond Gas Stove and Meter Company, Limited.

The manufacturers of gas-fires have all, year by year, done their part in meeting the needs (referred to in the preceding paragraph) that time and experience have disclosed. What the gas manager wants to-day, says the Richmond Gas Stove and Meter Company, is that the gas-fire makers should provide him with as many facilities as possible for hiring-out fires and maintaining them. The Company have year by year contributed their quota to such facilities; and this season again they have produced a series of designs which provide further facilities in this way. They have designed a fire, with a series of casings, and every other part interchangeable, so that the fires will at once suit any grate in a house, meet the varied fancies of customers, and provide for economical maintenance and repair. A bed-room fire grate is different from a dining-room grate, a dining-room grate different from a study grate, and so on; and each position needs a gas-fire with a different shaped top—as the case may be, round, straight, or flat. The new series of fires is known as the "A. B. C.;" the title for the series being obtained from the individual titles of the fires—viz., the "Arabian," the "Bavarian," and the "Castilian." When a gas manager is considering the question of the hiring-out of gas-fires, he naturally discerns difficulty and expense in keeping in stock the parts necessary for fires of many different designs. But in this series, the main parts of the casing fitting the same base and fire, and the parts of the base and fire being all uniform in the series of fires, it is easy to meet the requirements of consumers, aud yet not have to keep in hand a considerable stock of wearing parts for replacements and repair. Thus the wearing parts of a 10-inch fire are interchangeable with any other 10-inch fire of the series; and the parts of a 13-inch fire can be used with any other 13-inch fire of the series. In maintenance this is an exceedingly important feature. The wearing portions of a fire are, of course, the brick, the guard, and the burner—in short, those portions that are subject to the immediate influence of the heating by the flames; and it may be readily imagined how greatly it will reduce the question of maintenance to have on hire a series of fires the wearing parts of which are applicable to all, whatever the design of the outer casing. One of the illustrations shows how easily the whole fire is capable of being taken to pieces for cleaning and renovation. By the removal of two thumb-screws, the fender (to which are attached the two upright side arms and a white enamelled burner cover), can be lifted away, the burner can be slid out, the fuel guard can be taken off, and the fuel and fire-brick taken out. The complete dislocation of the wearing parts of the fire is, in short, the work of but a couple of minutes; so that it is seeu to what a simple and economical thing maintenance has been reduced.

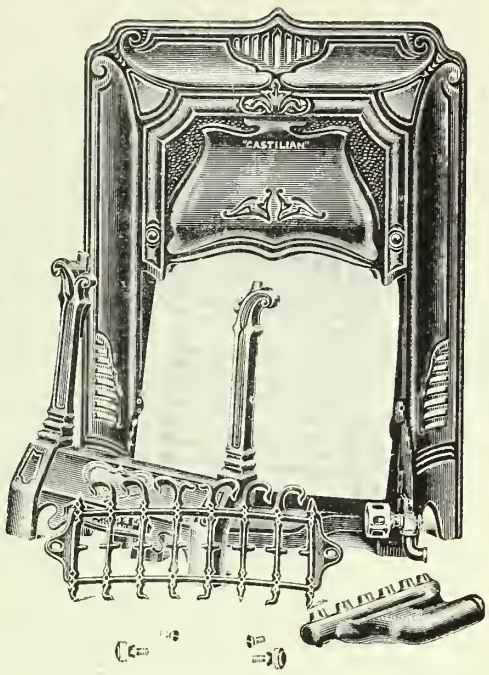
The parts, in view of the illustrations, hardly need any description; but it may be briefly mentioned that the principal brick is in one piece (about this there is something more to notice presently) and the burners have been provided with duplex orifices instead of single ones. The duplex nozzle gives in the place of one flame two flames distinct at the bottom but uniting at the top. The object of this is, without increasing the consumption, to give a larger surface of flame over the fuel to be heated. The fuel is made oval in section, and in longer pieces than formerly, so that one row of pieces of fuel standing vertically over the burners, with a single row laid horizontally along the top, is all that is required. It is agreed by almost everyone now who has made a study of the gas-fire that the nearer to the front one can bring the brick, the greater the radiated heat; but the difficulty is that a shallow fire meaus a shallow appearance. To get over this, and still have a shallow fire, the Richmond Company in this series have provided for a false brick back. That is to say, there is a brick that stands in front of the ordinary one. The dual brick has a dual advantage. A big heat radiation is obtained with the single row of fuel; and the false brick (which is quite an inexpensive thing) preserves the larger one by shielding it from the fiercest of the heat which—through expansion and contraction and mechauical disintegration—produces cracks which are an eyesore, and ultimately the destruction of the brick. Another new feature iu this series of fires is that this seasou the Company have adopted a separate gas and air adjustment. Last year, the air and gas were adjusted by one action; but, while the idea would be good if in all places the gas was of the same constitution and pressure, separate



The "Arabian" Fire.



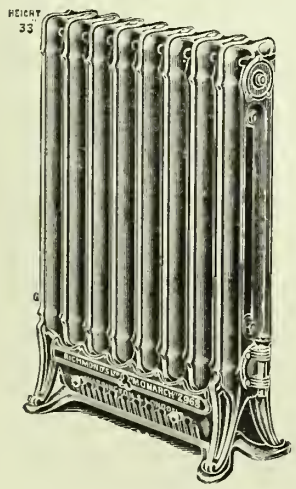
The "Bavarian" Fire.



The "Castilian" Fire,
Showing the Interchangeable Parts.

adjustment for varying conditions is no doubt preferable. The gas-adjuster is simply a needle-valve, with a grooved head to be turned by a screw-driver; and, when the gas is properly adjusted, a screw collar locks the adjuster in position, so that the adjustment cannot be accidentally altered. A small feature which the Company have patented merely for protection is a simple method of constructing the needle valve so as to ensure the cone-shaped head being kept central with the outlet from the gas-injector. A movable collar is used for the adjustment of the air supply; and the mere turning of a nut locks the collar in position when the regulation is completed. While provision for gas and air adjustment is necessary in the causes of efficiency and economy, experience shows that, with gas-fires, it is just as well that the facility of adjustment should not be so great as to court constant interference. In this case, the gas-adjuster requires a tool in the nature of a screw-driver for its movement; and the air-adjuster is placed out of sight under the fender of the fire, and yet is accessible to the fingers. A further feature—small but convenient—is that the connecting elbow to the fire can be turned, so that connection can be made with a gas supply on the opposite side of the fire to the entrance of the burner without any exposed connection or tortuous pipe-fitting. The fires are all fitted with sheet-steel backs, so forming a hot-air chamber, and preventing a large escape of heat up the chimney.

With regard to the general appearance of the fire, the illustrations speak for themselves. The characteristics of the design are tasteful. We like the wide, deep-set ornamentation which brings the features into striking relief, and enables any dust to be readily removed. The wide and deep tracings are also beneficial in yet another way. The finishes in "Porcellanite" colours have become very popular, harmonizing as they do with all schemes of room decoration; and, with deep grooves, the application of the Porcellanite does not destroy the effect of the design by filling them up. We like the design; and in use the fire emits a good heat, and is altogether very attractive. The Company assert that it is reasonable to claim that from this fire, they can get approximately 15 to 20 per cent. more heat than from their productions of last season, with a gas consumption of 18 to 20 cubic feet at 2 inches pressure.



The Single-Tube Gas-Steam Radiator.

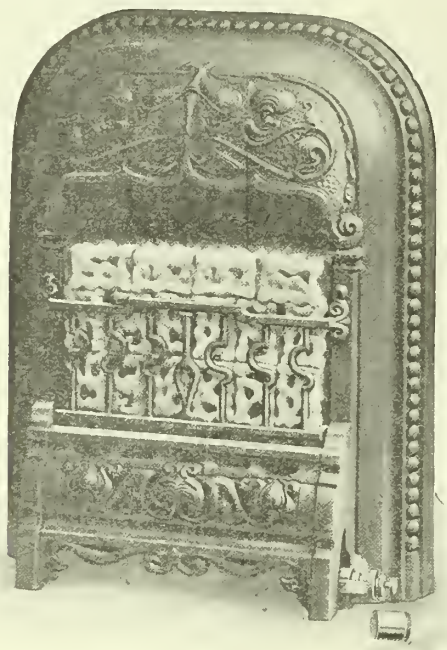
Looking round the Company's show-rooms, there are several other interesting features; but space compels us to pass them by with only a few words. The Company have this year brought out a single-column gas-steam radiator, of the "Monarch" series. This is very useful for narrow halls and passages. On the gas-steam radiator question, it would be easy to dilate on the advantages of such arrangements for the heating of large and well-ventilated halls and other places of public assembly, compared with central steam-heating systems, which involve much labour, and heavy capital expenditure. A cheap line is a fire, named the "Persian," with a 9-inch burner, and fitted with a single row of fuel, copper reflectors, and so forth. In use, this fire gives a good account of itself. Handsome are the finishes of other stoves; but with a mention of the "Neptune" water-heater and circulating system, the efficiency of which may be tested at the London show-rooms, we must leave the Richmond Company's interesting collection of new goods.

Parkinson and W. & B. Cowan, Limited.

In order to meet the demand for fires with single row of fuel and gas and air adjuster, Messrs. Parkinson and W. & B. Cowan, Limited, are introducing for the coming season a number of new patterns so fitted, foremost among which are the "Coral" and "Opal" here illustrated. The patent adjuster is extremely simple; provision being made for manipulating the gas and air separately, while the fire is burning, by means of the knob and slide, lettered B and D. The adjuster is placed at the side of the fire—quite accessible; and repeated tests have proved it to be very efficient in action. The fuel used is of special registered design as illustrated; the important improvement being that, in order to obtain greater duty from the gas consumed and a more brilliant incandescence, points are projected inwards to meet the flame. Owing to the perfect combustion secured by means of the gas and air adjuster, the full effect is obtained from this new pattern fuel; and a remarkably hot fire is realized at an exceedingly small consumption of gas. Among other patterns of fires may be mentioned the "Topaz," "Cameo," "Corona," all of

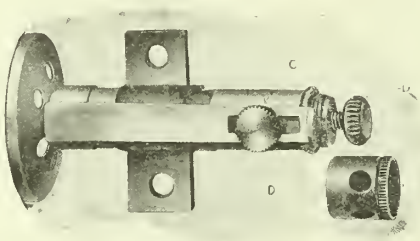
"Coral," with 10-Inch Fire-Opening.

which, together with the "Opal" and "Coral," are suitable for use in dining-rooms, nurseries, &c., as well as slot gas-fires if so desired. The designs are such as will suit varieties of style and many tastes, and the stoves can be supplied in various finishes. including porcelain enamel in many shades, electro brouze, &c.



"Opal," with 8½-inch Fire Opening.

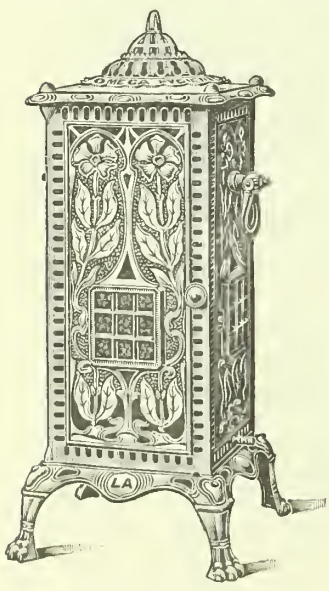
Registered Design in Fuel.



Patent Adjuster.

Omega Odourless Gas-Stove Company, Limited.

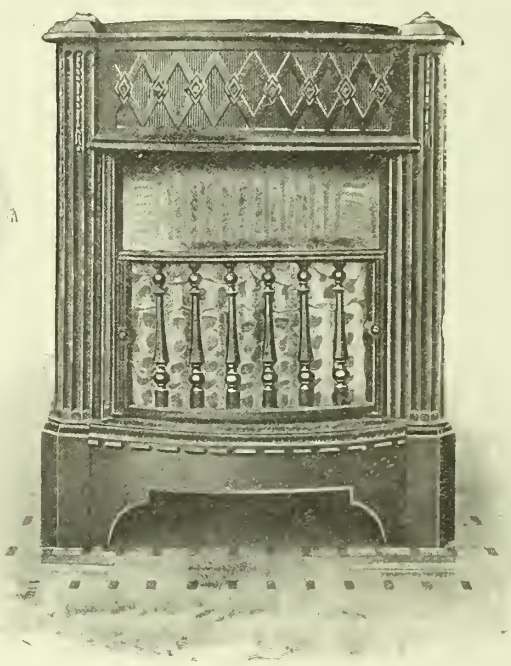
The "Omega" Company have what is described as "a new departure" in gas-heaters. It is a stove constructed on their ordinary scientific system for producing a rapid circulation of hygienic hot air; but, in addition, it is fitted with ruby squares, through which it diffuses a warm and cheerful glow. Therefore, while giving off great heat, the stove will also look hot. The new heater will be distinguished by the letters L A and No. 145. The height is 26 inches; and the size at base 12 inches square. The weight is 34 lbs. Full on, the gas consumption is 10 cubic feet an hour at 2 inches pressure; and the stove is suitable for a room 10 feet square. It may conveniently be mentioned here that a large type of the "Omega" heater has recently undergone a scientific test by Dr. E. H. Cook, F.I.C., F.C.S. The experiments were made to ascertain the exact effects on the air of a room due to the operation of an "Omega" heater, and also to determine the nature of the products of combustion. The figures, taken from a typical experiment, aud given below, are significant, in view of the continual discussion as to whether a flueless stove is compatible with a healthy condition of the atmosphere in the apartment in which it is used. The only condition to be observed is that the ordinary and intelligent means of ventilation are to be employed, such as would, under any circumstances, make the room fit for human occupation. The stove used was of the type known as F3; and the following are the particulars of the report: Duration of test, seven hours; area of room, 4170 cubic feet; mean gas pressure, 2·47 inches; amount of gas used during test, 238·5 cubic feet; gas consumed per hour, 34 feet; carbon dioxide produced per hour, 18·7 cubic feet; percentage of carbon dioxide in room after seven hours, 8·6 parts in 10,000; acetylene, *nil;* carbon monoxide, *nil;* sulphur dioxide, *nil;* unburnt gas, *nil;* average temperature rise, 9·7° Fahr.; amount of gas to raise 1000 cubic feet of air 1° Fahr., 0·607 cubic foot; smell in room, none; general remarks, the combustiou was complete, and no harmful products evolved.



New Pattern of "Omega" Gas-Heater.

Wilsons and Mathiesons, Limited.

This firm draw special attention to their "Bijou" gas-fire, the design of which is up-to-date, and in keeping with the prevailing fashion of restful designs. It is furnished with special double length fuel; and the burner, in addition to being loose, is fitted with gas and air adjustment, under special licence from Messrs. Bray and Co. The top of the stove is either fitted with a boiling-burner or with a double-flue top, having holes cast through for the heating of the air of the room. The advantage of this top is that a great amount of heat is taken out of the waste products before they escape into the chimney. Some idea as to the utilization of formerly wasted heat may be gained from the fact that, in an ordinary stove with the direct-flue outlet, the flue temperature will reach 500° Fahr.; but with the double hollow top, the flue temperature is only about 300° Fahr. Seeing that heat that does not go up the chimney must pass into the room, it is obvious that a great advantage is obtained by this addition, and as this does not interfere in any way with the artistic appearance of the stove, or add seriously to the expense, it is without doubt, the firm submit, a desirable combination to obtain as much radiant heat as possible from the fire by means of the double-length fuel, and then to economize the waste products—heating the air of the room directly by convection. Wilsons and Mathiesons are also making a speciality this season of porcelain enamel on their stoves; the "Bijou" fire lending itself specially to the process of both majolica and chimatto enamel in combinatiou.



The Wilson "Bijou" Gas-Fire.

The firm have also introduced a patented lock-tap. This is intended for the use of hotels, &c., where gas-fires are becoming extensively used in bedrooms, as by the use of the tap gas cannot be obtained without the assistance of the servant to unlock it. On the tap being turned off, it locks itself. The tap—a sample of which we have inspected, and can speak to its effectiveness—should have an extended use.

John Wright and Co. and Arden Hill and Co.

These united concerns have several new features in hand for the coming season, which promise to be both of value and interest. They are not quite ready for the publication of a description; but, as early as possible, we shall give an accouut of the features of their fresh productions.

Carron Company.

This Company inform us that they have some new gas-fires in course of preparation; and shortly we hope to publish a description of them.

Davis Gas-Stove Company, Limited.

This Company inform us that they are this season introducing some novel and important features into their new series of "Diamond" gas-radiators. In the matter of gas-fires, they are

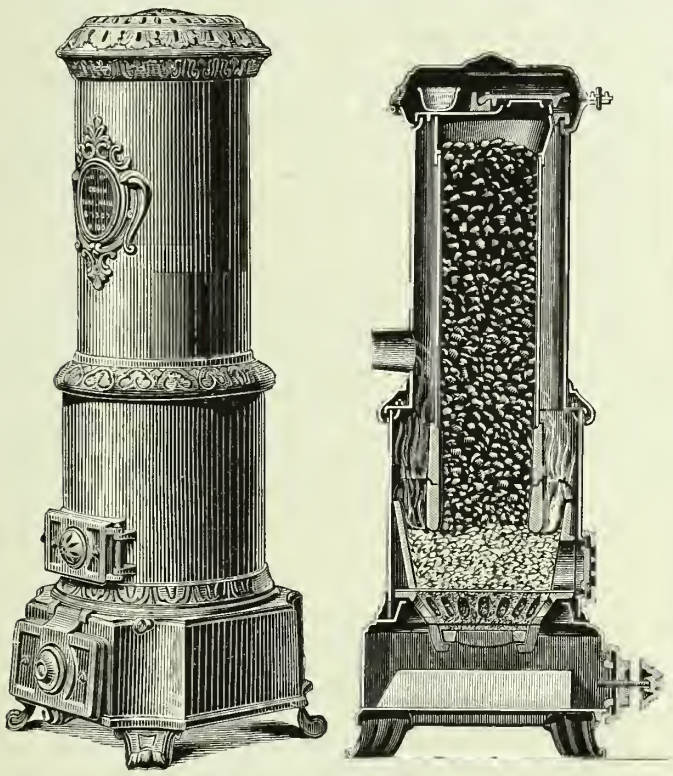
producing some new and very effective designs, incorporating heating chambers, single-row fuel, and gas and air regulation.

Imperial Stove Company.

This Company are also bringing out for the coming season a number of new designs in fires and other novelties. The encouragement received last season will induce them to make a special effort with their gas-heated steam-radiators. Additions have been made to the patterns; so that the Company can build up radiators with any number of double loops, from three up to fourteen, and in three different heights—viz., 27½ in., 32½ in., and 39½ inches.

A. G. Cloake.

Gas engineers who are interested—and what gas engineer is not?—in stoves to burn coke will appreciate the excellent results obtained with such stoves as are shown and sold by Mr. A. G. Cloake, the representative of the well-known works of Godin et Cie., of Guise, France. These coke-stoves are constructed upon scientific principles, calculated to yield the maximum amount of heat at the minimum cost. They are absolutely free from dust, back-draught, fumes, or smoke, and will burn continuously throughout the winter, if charged regularly as required, every 12 to 48 hours according to size. The appreciable advantages of having rooms warm in the morning, no fire-lighting, no dust or back-draught, have, Mr. Cloake informs us, established a permanent demand in England for Godin's stoves. It is evident that no expense or practical experience have been spared, in order



The Improved Coke-Stove.

to put on the market stoves which are absolutely perfect, reliable, and lasting. There are several hundred patterns, from the plain sheet-iron bodied stove, to the most elaborate designs, with heating capacities varying from 700 to 70,500 cubic feet, and suitable for the smallest to the largest rooms, halls, hotels, shops, churches, &c. The stoves can be porcelain enamelled in any shade to match the general scheme of decoration, with nickeled, brass, or copper mounts. While inquiring into the question of stoves, Mr. Cloake gave some information about the large works of MM. Godin et Cie. They were established in 1840, and 2500 hands are employed making cooking and heating stoves, for burning gas, wood, coal, coke, and anthracite, also general castings for the trade, such as enamelling muffles, annealing kilns, nickeling and galvanizing installations, and kilns for the manufacture of refractory fire-brick, &c. The firm enjoy a world-wide reputation for the production of fine castings. Their continuous moulding machinery—the only one of its kind in existence—permits of a comparatively unlimited output of castings, from which many British ironfounders are drawing an important supply.

[Other notices will appear in subsequent issues.]

The "London Gazette" recently contained a notification from the Inland Revenue Office to persons entrusted with the payment of annuities, dividends, &c., at home or abroad, that within one calendar month from the 21st ult., they must notify the office of the names and residences of the parties to whom such payments are made, and of the amounts paid to them.

IN THE LIGHTING SECTION.

No startling improvement, so far as we have been able to gather, seeks welcome for the coming lighting season; but advance has not been stayed. In the making of vertical incandescent burners, experience continues to bring innovation in detail. But it is on inverted burners that most work has of late been expended; and they have been brought up to a high pitch of perfection. As we look back at the difficulties associated with the first burners, one can but marvel at and admire the perseverance that has conquered the infantile troubles. What at one time looked to be impossible has been proved to have been possible by achievement. One of the discoveries of experience has been the necessity for a nice adjustment of the volume of gas supply to the burners without diminishing pressure; and some excellent regulators which accomplish this are now attached to several of the new burners. The regulation of the air supply is really a secondary consideration when there is the requisite fine control of the gas supply. To this discovery, and to the provision of regulators of the necessary type, may be attributed perhaps more than to anything else the excellent results in illuminating power and general efficiency of these burners. Some of the efficiencies now quoted by makers are remarkably high; but it is easy to test veracity when it can be done by a photometer. Another matter to which increasing attention is being paid is the diverting of the products of combustion so that the primary air supply is not vitiated. Progress in performauce has becu comparatively slow but sure; and now the reputation and popularity of the inverted burners are spreading rapidly, while their artistic appearance is also a strong recommendation. Consequently, we hear of big business being done in them in all quarters. There is one point upon which necessary attention is now being bestowed, and that is the provision above the inverted burners of means for preventing the tarnishing of the metal and the accumulation of incrustation. Some successes are recorded in the following paragraphs. It would be well if gas managers would inform consumers that the occasional use of a damp cloth will remove all unsightliness in this respect. In high-pressure lighting, too, we have only to call to mind the display at the Dublin Exhibition, to be thoroughly contented with the advance in that brauch of the business.

George Bray and Co., Limited.

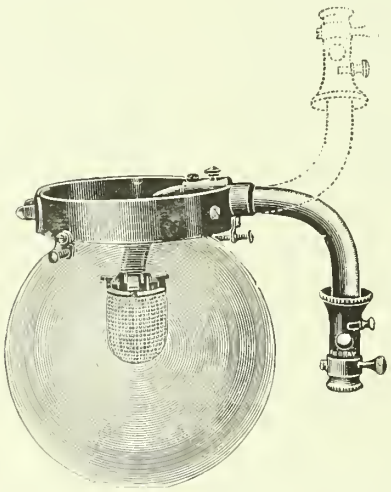
On the next page is reproduced a very interesting photograph, taken at 8.45 one evening, in the Lewisham Postal Sorting Office. Of all places where an excellent light is required, a letter-sorting office must stand out prominently; the good light being necessary to assist rapid work and the deciphering of the hideous writing with which letters are frequently addressed. The task of the post-office letter sorter is difficult enough at all times; but his troubles are increased if he is not favoured with a good light for his night duties. The sorting-office pictured here is lighted by the Bray inverted burner, fitted with bye-passes; and well lighted it is too—the light being directed exactly to the places where it is required by the sorters. We are sorry the effect of the lighting is largely lost in the reproduction and printing. But it is sufficient to know that the photograph was taken by the light of the burners, and that this is not the first place in connection with our great Post Office system in which Bray's inverted burners have been installed. They have found their way into several other post offices in the Kingdom, and are giving general satisfaction, both in respect of efficiency and economy. That their use spreads in post offices certifies to the truth of the statement as to general satisfaction. As a precaution against a globe being broken, and the pieces while hot falling among letters, a wire basket is suspended from the spring holder by which the globes of the lamps are supported.

At the London show-rooms, at 17, Farringdon Street, all the firm's new improvements in incandescent burners are to be seen. Their reversible inverted burner—which can be fixed to pendant, standard, or bracket without the use of an adapter piece, has all the metal parts exposed to heat hidden from view, and has the before-mentioned spring-clip support for the globe—has hitherto been made in the large and the bijou sizes. But the firm have now brought out an intermediate size, which will be known as the No. 2 reversible burner. The ordinary sized inverted burner consumes 3½ cubic feet an hour; but this intermediate burner only uses 2 feet, and gives a light of 40 candles. Its illuminating power is good; and it meets the want of a burner for those situations where a full-sized burner affords more light than is essential, and where the light of a single bijou is insufficient. This burner (as are also the No. 3 burners this season) is fitted with the Bray patent gas-adjuster, which permits the control of the supply of gas to the burner without decreasing the gas pressure. The new "Bray '07" vertical inverted burner (so called to distinguish it from the swan-neck reversible burner) is fitted with an earthenware deflector, which can be revolved so that it can be cleaned without removing the globe or mantle. The earthenware deflector, besides diverting the current of the products of combustion, acts as a reflector, and so diffuses the light. The Nos. 2 and 3 reversible burners and the vertical inverted burners can be had fitted with or without a bye-pass, which is so fixed that the point of ignition is above the mantle, and so ensures that the mantle suffers no violence from the use of the bye-pass.

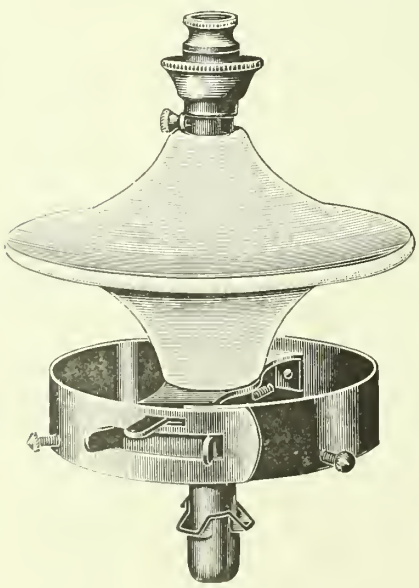
Quite a new departure is the "Bray '07" "C" burner fitted with

Lewisham Postal Sorting Office Lighted by Bray's Reversible Gas-Burners.

the patent gas-adjuster, and with or without bye-pass. In certain respects, the burner is unique. It is constructed in four pieces, which simply slide together; and thus all parts can be cleaned, and are interchangeable. The burner has a long mixing chamber,



"Bray No. 2" Reversible Inverted Burner.



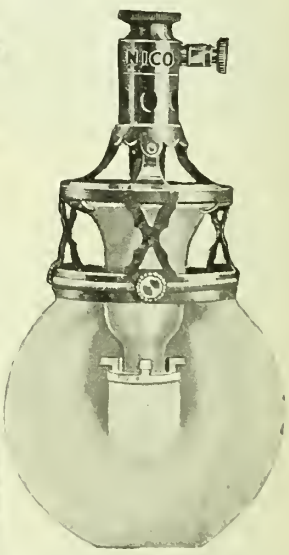
"Bray '07" Vertical Inverted Burner.

with the top of the interior tube reticulated for some distance down so as to assist in the thorough mixture of the gas and air. A brushing out at wide intervals will keep the interstices free. The burner is also constructed with a nickel tip, which is non-corrosive. It will not burn out; and it is stated that dust will not adhere to it, as in the case of wire gauze. Tested without a chimney, the illuminating power attributed to the burner is 24 candles per cubic foot of gas consumed. It is therefore an economical burner, and promises to win a large share of favour. The firm have equipped themselves thoroughly for meeting the demands of the coming season. Looking round their exhibits in the show-room, it is seen that they have, among other things, a good range of anti-vibration fittings. The mantles they supply are all of British make.

New Inverted Incandescent Gas-Lamp Company, Limited.

The New Inverted Company have had so many good features among their burners and fittings that we had begun to think they must have arrived at the ultimate point of success in high-class production. But experience of the "Nico Intense" lamp, of the new (or No. 5) "Bijou" gas-burner, and of the "Nico" regulator, which are the three foremost specialities with which the Company are in the field this year, has disabused the mind as to finality in

"Nico Intense" Lamp, Half Full Size.



"Nico Bijou" Burner No. 5 Half Full Size.

production and results. For, applying the test of efficiency, never before have the Company succeeded in gaining such results as are procurable with the "Nico Intense" lamp and the new "Bijou." How much this is due to the "Nico" regulator, and how much to other improvements in the make of the burners, we cannot deter-

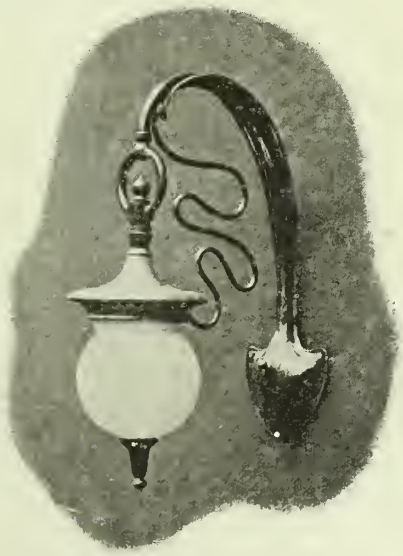
mine; but that proper regulation does play an important part in efficiency, we are fully persuaded by the use of similar burners both with and without the regulator. The "Nico" regulator was described in our issue for July 2; and therefore all we need say further about it now is that the Company have received some excellent accounts of the usefulness and effect of the arrangement from different parts of the country. We prognosticate it will be a popular feature of the burners during this winter season.

Regarding the new "Bijou" (or No. 5) burner, it is on the same principle as the Company's now well-known No. 4 burner, with mixing chamber, but is practically the same size as the No. 3 Bijou. The burner has been produced after most exhaustive tests and experiments; and it can certainly be recommended as highly efficient and satisfactory—a photometric test having recorded an illuminating power of 30·5 candles, with a consumption of 1·3 cubic feet per hour, which works out to 23·4 candles per cubic foot of gas. On seeing the burner alight, and noting its good performance, it would be little short of an impertinence to question the accuracy of the test—in fact, it is well within the mark using 15-candle coal gas. The burner is perfectly silent, neat in appearance, thoroughly well made, and is fitted with the "Nico" regulator, which enables it to be adjusted to suit practically any conditions of gas supply.

In regard to the "Nico Intense" lamp, this can be thoroughly recommended as a nicely finished article, at a reasonable price. The lamp is on the self-intensifying principle; the mantle being inside an inner glass cylinder, and is used with an opalene or etched globe according to requirements. Photometric tests of the lamp record an efficiency of 28·4 candles per cubic foot of gas consumed. One of the special features in connection with the construction of the lamp, is that there are air-holes in the regulating shutter of the bunsen only on one side, and that is diametrically opposite the opening for the escape of the products of combustion. This construction prevents the entering air being contaminated by the escaping products of combustion. The lamp is fitted with a "Nico" gas-regulator, and can be had finished in polished brass or black bronzed. Judging from the manner in which it has already been received on the market, it is bound to be a popular lamp during the coming lighting season.

Ecliptic Gas-Light, Limited.

The Ecliptic Gas Light, Limited, are now producing their well-known "Palace" burners—in which, by the way, they have a range to meet all requirements of place and purpose—with china deflectors, combined with a novel arrangement (which has been provisionally protected) of combining brass and aluminium, so that while only aluminium that will not tarnish or discolour is presented to the eye, the burner is so cased with metal, that it retains all the strength of a burner made in the ordinary way. We have seen a number of these lamps, and are extremely pleased with the effect. It is unquestionable that they effectually prevent the eyesore of discoloration and incrustation above the burner. In the "Palace Extra," for example, we have a lamp



The Attachment of the "Palace" Burner to a Bracket.

the head of which is constructed of brass with aluminium spun over it. The "Palace" lamp, too, is made with a white china top, and aluminium support for carrying the globe. The "Medium Palace" has a china top; and the globe is supported from the bottom by a patented arrangement. The same lamp is made with a metal top covered by aluminium. The series of "Baby Palace" lamps and other types have been treated in the same way. They have all a natty and really handsome appearance; and for them we anticipate there will be a considerable amount of patronage.

To meet the demand for a burner which is readily adjusted, the well-known movable plug is now fitted with a special arrangement of needle regulator, the needle of which cannot very well be put out of adjustment by careless dusting or matters of that kind, as it is concealed, and so kept out of harm's way. A demand for cheaper burners has also been created; and such burners can likewise be now supplied with many of the Ecliptic Company's specialities, and fitted with the adjustable nipples. The Ecliptic Company do not appear to be favourably disposed to adjustable nipples, though they comply with the demand for them; for Mr. J. Reid, the Manager of the Company, states that he "is convinced that the craze for adjustable nipples will only tend to emphasize the advantage of the movable plug and the gauged nipple. Gas-fitters have lately considerably improved in their

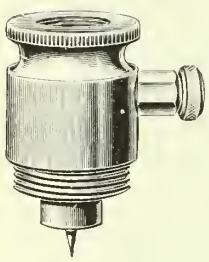
The "Palace Extra" Burner.

treatment of inverted burners; and it will not be long before they will all be able to fit the right nipple in a burner." The Company are showing a novel and attractive application of the ordinary "Palace" burner to a bracket. The bracket lends itself very well to the pneumatic valve or the "Norwich" switch. It is particularly neat in appearance; and attention may be directed to the pilot-light tube, which, it will be observed, is arranged in an artistic manner. The second illustration is the new "Palace Extra" burner, which, it is claimed, will give 120 candles for 4 cubic feet of gas. The burner is fitted with an inner chimney, and the products of combustion are evenly distributed throughout the whole circumference of the burner, which does away with all smoke and discoloration of the upper part of the fitting. The burner is fitted with an adjustable nipple and china top.

Messrs. Bland and Co.

The Bland inverted burner, as predicted when it first of all came on to the market, has realized a large measure of popularity; and several authorities—among them Mr. W. R. Herring and Mr. J. D. Ashworth—have spoken as to the burners fulfilling in all respects the claims made for them by Messrs. Bland and Co. Inquiry as to what is new in connection with the burner has elicited several interesting points. An improved gas-regulating nipple, with side adjustment, has been adopted. But the triangular form of needle communicating with the round hole of the gas-injector has been maintained; so that, while the quantity of gas passing can be controlled, the pressure is in no way affected. Then the firm have introduced an anti-lighting-back arrangement, which, we are informed, effectually prevents lighting-back under either low or high pressure; and, while fulfilling this object, it also greatly increases the lighting efficiency of the burners. Recent tests made by a gas engineer attribute to the burner an efficiency of 32·4 candles per cubic foot, which works out to 97·2 candles for a gas consumption of 3 cubic feet. This is such a remarkable result that there will be a desire on the part of gas engineers to make personal corroboration. A new form of protecting hood has also been devised, which diverts the products of combustion from the mixing chamber, thereby ensuring a pure and cool supply of primary air, and also prevents any direct upward flow of the products, and so obviates discoloration of the fittings and ceiling. The hoods, we learn, are made of a non-corrosive metal, which will not discolour or accumulate incrustation. The importance of this needs no words to emphasize it. The firm's bijou burners have been improved in every respect. They are all fitted with the patent gas-regulating nipple, the anti-lighting-back arrangement, and a steatite nozzle. These small burners are credited with an efficiency per cubic foot approximating to that of the larger types of the burners. For factories and workshops, special burners have been made, with enamelled green iron shade and white reflector, and the fittings are of a character befitting their use. The principle adopted in the Bland

burners, of placing the mantles in the globe and not attaching them to the burners, has proved invaluable for maintenance work. In numerous places where there is heavy machinery running, and where mantles were formerly constantly meeting with destruction, the application of this system of supporting the mantles has, we learn, redeemed the reputation of incandescent gas lighting. In glassware, it is found that Messrs. Bland and Co. have added many new designs—making a special feature of the Adam style of decoration, which is now so much the vogue.



The New Nipple

"B" Burner, with Adam Globe.

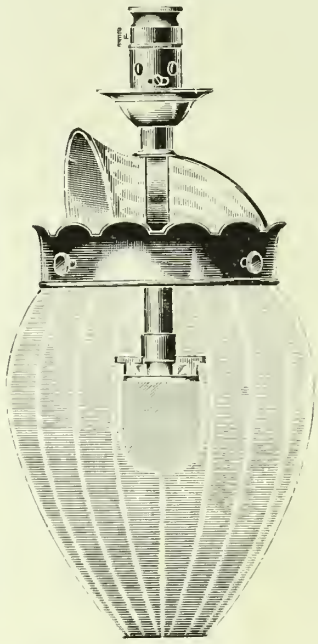
Fitting in Adam Style of Decoration, with Globe to Match.

No. 7 Factory and Workshop Fitting.

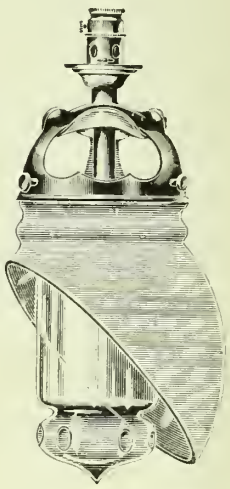
The fittings supplied by the firm are of the very best workmanship; and a special feature of them, as shown by one of the illustrations, is again the Adam style of decoration. It may be added that, in order to cope with the large increase of business, Messrs. Bland and Co. have found it necessary to take new offices and warehouse at No. 29, Little Trinity Lane, E.C.; but the London showrooms will still be at No. 63, Queen Victoria Street. A branch for the North of England has also been opened at No. 20, Fennel Street (off Corporation Street), Manchester.

Falk, Stadelmann, and Co., Limited.

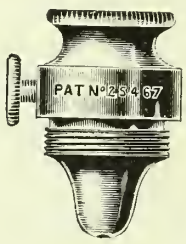
In the extensive show-rooms of Messrs. Falk, Stadelmann, and Co., Limited, interest is always aroused, and invariably there is something new to be found. This season is no exception to previous ones; but there are only two or three new examples that we can describe. In the first place, there is a new pattern incandescent burner, with a solid steatite burner head (non-corrodible), with lift-off top. The burner is fitted with an air-shutter and gas-adjuster, which not only enables the consumer to adjust the burner at the point of fixture, but to effectually keep the gas-inlet free from dust or foreign matter. One aim has been, in designing this burner, to keep the price as low as possible, in order to bring it within the reach of the general public. The patent gas-adjuster is also applied to a cheaper quality burner with a screw-head, as well as to inverted burners. The part may also be bought separately; and will be found suitable for any inverted burner.



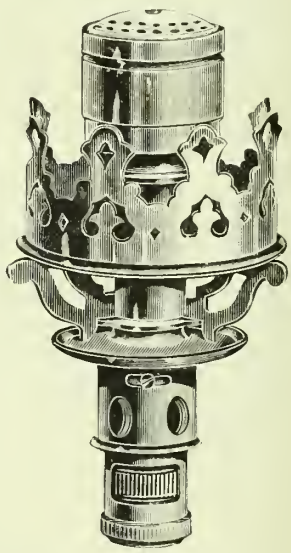
The "Veritas Shell" Burner.



A Side Reflector for Shop Windows.



The Patent Gas Adjuster.



A New Pattern Burner.

The "Veritas Shell" inverted burner—a name derived from the shape of the porcelain top—is an attractive production. It encloses the glass holder on three sides—leaving an exit only at the fourth; thus effectually screening the fittings from discoloration by the products of combustion. It has also been found that the small discharge hole accelerates the flow of air through the globe, and produces a more brilliant incandescence in the mantle. The burner is also made in bijou size. The ordinary "Veritas" inverted burner we find may now be had in swan-neck as well as bracket form; and also each variation in the bijou size.

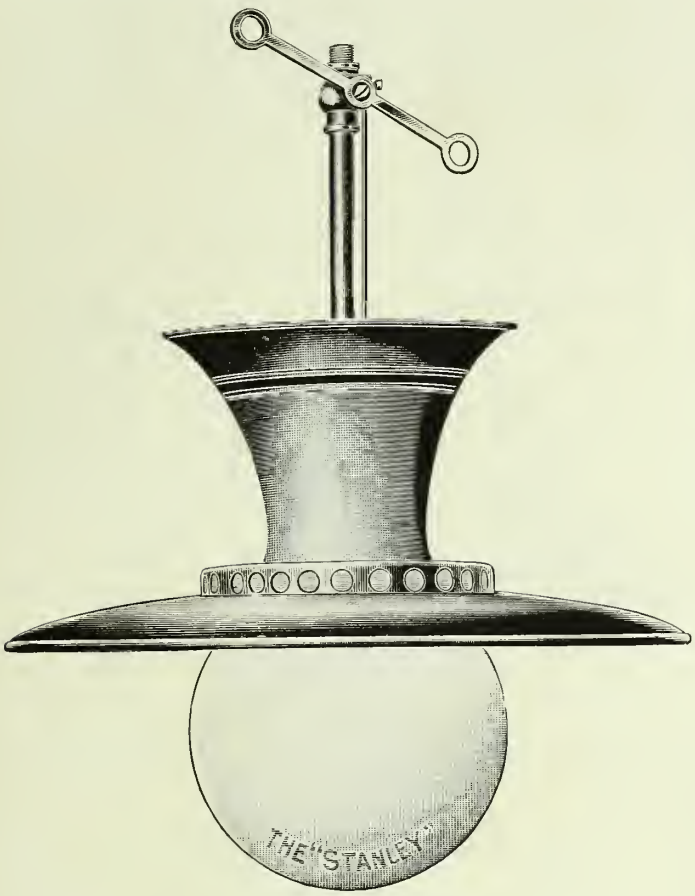
A large display of glassware is now being made in the showrooms; and apart from the many hundreds of different shapes, patterns, and colours to be had following on the usual lines, there are several novelties.

The opalene side reflector for inverted burners is a registered article of the Company. The idea is primarily for window lighting. The light is reflected on to the displayed goods, while the dazzling brilliancy of the mantle is screened from the observer's eyes. The bulb is also a registered pattern, and will fit nearly all open type shades for inverted burners. Apart from giving the inverted light a nearer approach in appearance to an electric light, the bottom of it is closed, which prevents the mantle ash or ring, should it break while incandescent, from falling upon inflammable material below. The constriction at the bottom of the glass acts as a baffle to the intake of cold air, and prevents the bunsen flame from being driven back from contact with the surface of the mantle, as is common with glasses having a single hole in the centre. Already the Company are experiencing a large demand for this particular glass; and it should certainly be appreciated by Insurance Companies.

Moffat's Limited.

Under the name of the "Stanley," Moffat's Limited have now introduced into their large range of lamps a new inverted cluster light, which it may be readily admitted is a very decided step in

advance of the firm's earlier efforts in this direction. The lamp is a three-unit inverted light, but constructed within a hitherto unattainable compass. The burners are strongly made, fitted with air-regulators, mixing-chambers, and regulating gas-nipples to ensure perfect gas mixture. The glass bowl is completely enclosed at the bottom; the air supply being drawn in from above, but through separate passages from the outlet, so that a constant supply of pure air is always available for the burners. The lamp is extremely compact, measuring only 15 inches across the reflector

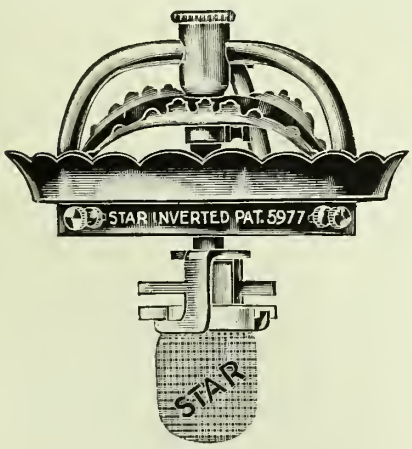


and 18 inches from cock to bottom of bowl. It is consequently suited to practically any room where a lamp of this class is desirable. In appearance, it is exceedingly attractive. In fact, it looks even better when hung than in the illustration—this being due to its small size, its excellent finish, and the peculiar character of the bowl. It is finished in white porcelain enamelled iron with gold lines, and is made for hard wear. The light given is of about 250-candle power, with a gas consumption of 10 cubic feet per hour.

The well-known "Sydney" lamp, which has been deservedly popular ever since its advent, has been further improved by introducing a supplementary reflector, which is fixed just above the glass bowl, so as to break up and deflect the current of air entering through the perforations. By this device, the bottom of the inner chimney is hidden from view, and an additional amount of light is reflected downwards, greatly improving the appearance of the lamp; while it also acts as a sort of baffle-plate in the case of outside lamps, and renders them thoroughly wind-proof in the worst of weathers.

Star Inverted Incandescent Burner Company, Limited.

The improved "Star" inverted burner has also its new and important features. Metal inverted burners have hitherto suffered under the heat of the bunsen flame. This has especially been the case when, owing to complete combustion, increased heat was produced. In consequence the movable burner tube has had to be more or less frequently renewed. The Star Company recognizing this defect, the patentee has for months been engaged in evolving a method to obviate and nullify the destruction. The improvement which he has effected consists of a magnesia burner tube, that is impervious to heat, and also effectually prevents the carbonization of the waste products upon the mantle rim. The "Star" burner has always stood in high esteem for its light-giving power; and the improvement will enhance its popularity.

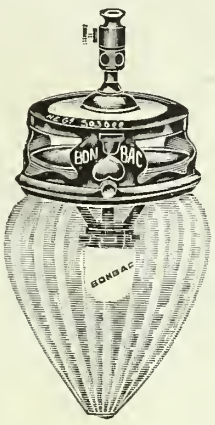


The Improved Burner.

Wholesale Fittings Company, Limited.

In addition to the "Yotto," the "Pyrol," and the "Kohab" inverted gas-burners, the Wholesale Fittings Company are this season calling special attention to the "Ezol" and "Bonbac" lamps. Both burners are fitted with special gas-regulators; and to the "Ezol" is attributed an illuminating power of 100 candles, with an hourly consumption of 4 cubic feet of gas, and to the "Bonbac" 80 candles, with a gas consumption of about 3 cubic feet. The "Ezol" is fitted with a closed globe; and the products of combustion are so diverted, as not to affect the primary air supply. The appearance of the lamps is good, as can be judged by a glance at the illustrations.

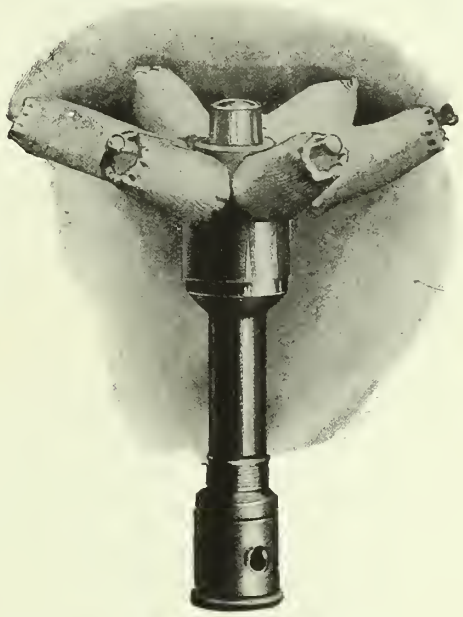
The "Ezol."



The "Bonbac."

Lune Light Company.

This Company are the sole patentees and manufacturers of the unique "Lancaster" burner, in the design of which the object has been to make an incandescent burner that shall distribute its rays, without the aid of reflectors, &c., at an angle where the light is most effective and where it is most required—viz., an angle of from 30° to 45° downwards—and to eliminate all shadows on either ceiling or floor. The head of the burner is made of a special anti-corroding composition. The bunsen flames issue out of a number of holes in this head in a horizontal direction, and above the holes a corresponding number of stalks project in a slightly inclined upward direction, and on each stalk rests a small mantle.



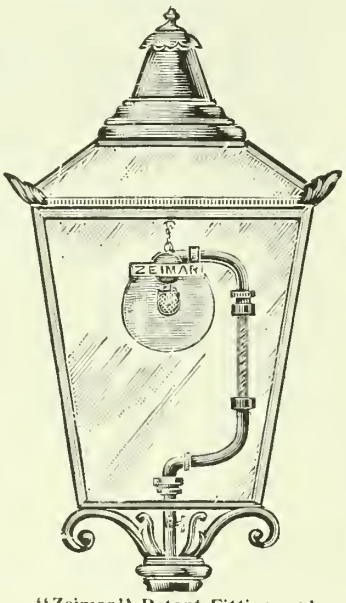
The "Lancaster" Burner.

"The horizontal flames," it is submitted, "come far more actively into contact with the air than is the case with the flame of a vertical burner, with the result that the combustion is absolutely perfect, and obtained without using a chimney to increase the draught—the illumination of the mantles being intensely brilliant, and no shadows on either ceiling or floor." The burner is provided with a special regulating nipple, which can be instantly adjusted while the burner is in use. It consists of a small cap which screws down upon the nipple, and which can be turned up or down with a pin, until the mantles become perfectly incandescent, thus showing that the right amount of gas is passing through the nipple. The mantles are specially manufactured, and of exceptional strength, having an asbestos ring top and bottom. By reason of their size, and the horizontal position in which they are carried, they will, it is stated (without the aid of anti-vibrators), stand a larger amount of vibration than any other burner on the market. Should a mantle be broken, the burner is not affected in the slightest degree, as the loss of light is scarcely noticeable. The burner can be used with the remaining mantles until it is convenient to replace the one broken.

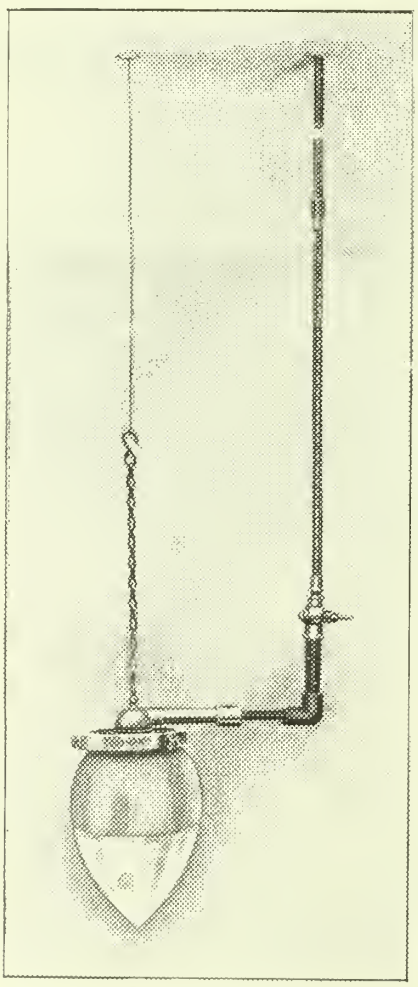
Ramie Company, Limited.

In the "Zeimar-Kent" patent burner, the Ramie Company, Limited, believe they have the "best and most scientific" upright burner that has yet been made. Whether this is so or not, we need not argue here. But that the burner can maintain a good position among its contemporaries is proclaimed by a test made against a 10-candle Harcourt pentane lamp, with a Simmance-Abady "Flicker" photometer, and using 15-candle power gas at 12-10ths pressure, when the result was equal to 20·92 candles per cubic foot of gas consumed. Beyond this nothing is required to give assurance that the burner has been constructed in the best possible manner for securing a high duty. The burner is fitted with a readily removable burner cap (so that it can be easily cleaned) and a regulating-nipple. The Company have also been turning their attention to mill lighting; and the latest fitting devised is one by which the gas is brought down, and fed into the bunsen tube of the burner, by iron tubing while the inverted lamp itself is suspended by a chain from the ceiling. A patent fitting and inverted burner has also been devised by the Company, whereby the inverted burner can be applied to ordinary street lanterns cheaply, and yet effectively.

"Zeimar-Kent" Burner.



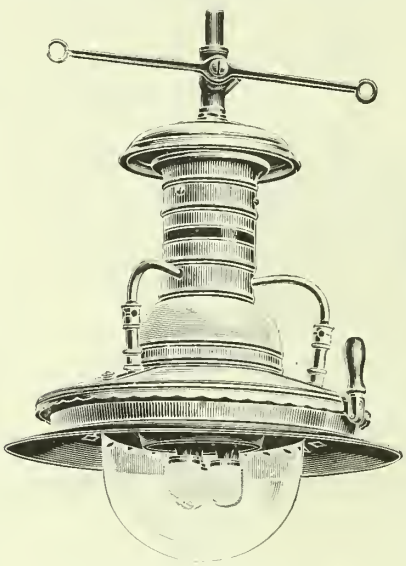
"Zeimar" Patent Fitting and Inverted Burner for Street Lighting.



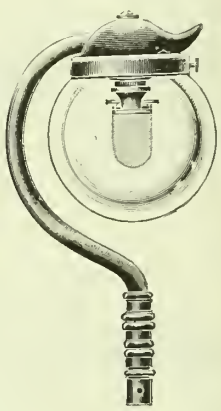
For Mill Lighting.

Messrs. Guest and Chrimes.

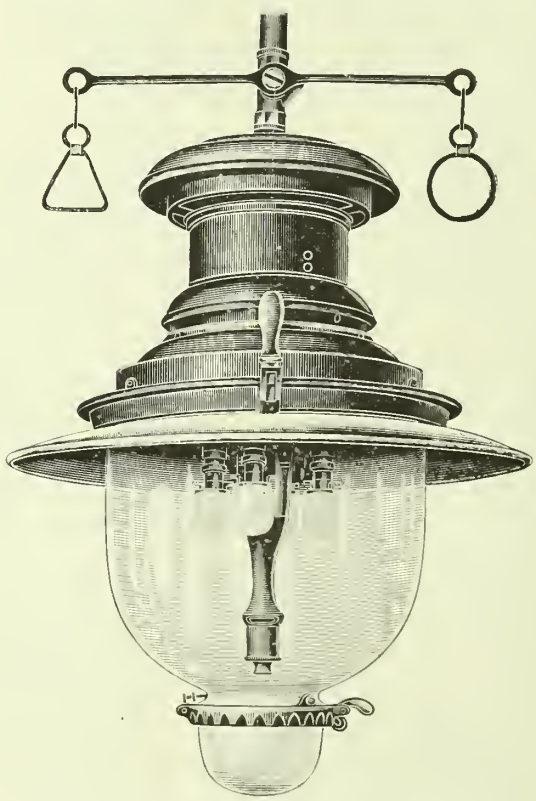
A large range of high-power lamps are provided by Messrs. Guest and Chrimes for this lighting season. It is interesting to note how, in these lamps, the inverted burner predominates over the vertical burner; and we must say that, for cluster-burner lighting in large suspension lamps for shop and outdoor use, the inverted burner is more sightly than those fitted with vertical burners. Two or three of the new lamps may be described briefly. The first one is a hinged bowl shop lamp, with inverted burners. It is a lamp of good appearance, and the points that go to make up a lamp in which utility is of first importance are present here. The lamp is enamelled in art colours, with gilt lines. It has a 16-inch reflector, and is fitted with a bye-pass lever cock, and pilot light; and the cast brass burners are detachable, and have non-corrosive magnesia nozzles. The mixing-tubes are carried outside the lamp; so that it is absolutely impossible to contaminate the air supply. The flame will not light-back; and an illumination is afforded that is at once shadowless and of great brilliance. The consumption of gas per burner is only from 2⅓ to 3 cubic feet per hour. The length of a lamp fitted with two burners is 21 inches, and fitted with three burners 24 inches. If desired, the lamps can also be fitted with a small separate outside controlling cock to each burner; thus allowing any burner to be shut off during use. For outside purposes, the newest series of lamps are being fitted with Cowan's upright inverted incandescent burners, as shown in one of the illustrations. This lamp has an olive green enamelled casing, with an 18-inch reflector, a 11½-inch hinged glass well, a 4½-inch lighting cup, with a bye-pass lever cock, and the patent upright inverted gas-burner. The lamps are fitted with two, three, or four mantles; and with a consump-



Shop Lamp, with Inverted Burners and External Mixing-Tubes.



Cowan's Inverted Burner, to Socket On and Off, with Smoke Shade.

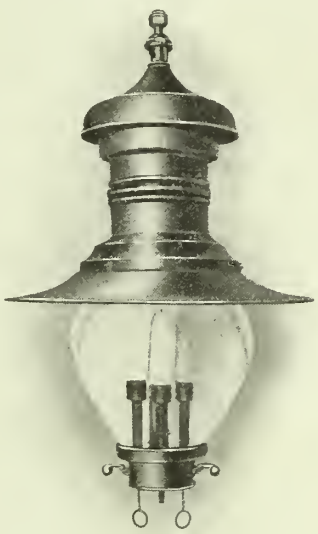


Outside Lamp, with Cowan's Upright Inverted Burners.

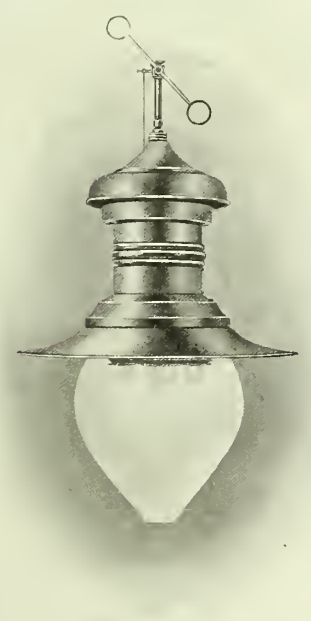
tion of 3 cubic feet an hour per mantle, a light of from 150 to 350 candles is obtained, according to the number of mantles fitted. Wind, rain, and dust proof, with perfect ventilation, and handsome appearance, are other attributes of the lamps. The length of the lamp shown is 27 inches. The lamps, it should be mentioned, are also made for the Welsbach-Kern burners. Cowan's patent upright inverted burners (to which reference has just been made) are an acquisition to the gas manager in improving street lighting, for they are also designed so as to be fitted in all existing lanterns, without any expensive alteration. The fittings are supplied for one to five burners. Each nozzle is made to socket on and off; and the consumption of gas is about 3 cubic feet for each mantle. The clusters look exceedingly well. The burner illustrated is one of the patentee's designs, to socket on and off, with smoke shade and holder for 5-inch globe.

Khoma Gas Arc Lamp, Limited.

Here we illustrate two new forms of outdoor lamp brought out by the Khoma Gas Arc Lamp, Limited. The lamp with the upright burners has several new features, which make it specially suitable for gas companies and corporation gas departments doing maintenance work. The mantle-shield which protects the mantles while the globe is lowered, and which has an opening allowing access to the mantles, is a strong feature, saving as it does breakage of mantles when attention is being given to the lamp at the time the wind is blowing. The bottom cup arrangement is also a novel feature. The Company have devised a fixed casting on the bottom of the lamp, which has a series of ledges over which small pawls work automatically, so that, when the globe is pushed up into position, these gravity-controlled pawls



"Khoma" Outdoor Lamp for Vertical Burners.



"Khoma" Outdoor Lamp for Inverted Burners.

automatically adjust themselves on the ledges. In the case of a globe being shorter than the ordinary size, the pawls would catch on the upper ledges; while in the case of a globe being longer than ordinarily, the pawls would catch on the lower ledges. Another special feature is that the pin in the bottom of the lamp has a hole in it, which communicates directly with the main valve. The hole in the bottom pin is closed by means of a screw plug, which can be readily removed, and a wire inserted into the valve, should it become clogged.

The outdoor inverted lamp is fitted with a cluster of inverted burners. One of the features is that the air-intake of the burners is isolated, and almost the entire burner itself is protected from the hot gases. In reality, only the extreme point of the burner becomes highly heated. This the Company regard as a valuable feature, as it eliminates the excessive heating of the mixture of gas and air, "which heating," they say, "tends to check the downward flow of the gases, as when they are hot they naturally have a tendency to rise. It also avoids the possibility of lighting-back." A further feature of the inverted lamp is that each mantle is provided with a separate flue; the several flues, being drawn, immediately above the mantles, into a main flue, which enables the production of a very pretty and effective lamp, and not a clumsy-looking one. The top of the lamp, in fact, is exactly the same as the top of the outdoor lamp with upright burners.

Parkinson and W. & B. Cowan, Limited.

Lamps for street lighting form an important department in the business of Parkinson and W. & B. Cowan, Limited; and in this department we find a large variety of recent patterns and important improvements of every kind. So many are they that we cannot illustrate or describe them all; but we may advise all interested to consult the firm's catalogue No. 54, which gives what we are unable to produce. The lamp No. 840 is one of the most popular patterns. It is made of hard rolled copper throughout, and is fitted with removable earthenware reflector, as well as a copper central flue, which prevents any possibility of down-draught. The whole lantern is strong and well constructed.

The firm, in their brasswork branch for street lighting, are making anti-vibrators, of which we illustrate No. 9. This anti-vibrator is found to be very efficient, providing as it does for both vertical and lateral vibration. It is adaptable to almost any class of incandescent burner.

Parkinson and Cowan's No. 9 Anti-Vibrator.

E. C. Hayward and Co.

The "Humphrey" lamp (for the introduction of which in this country Messrs. E. C. Hayward and Co. are responsible) has made for itself a position here by pure merit. It is well known, and calls for no description. The standard outdoor lamp is in largest demand; and following this the standard indoor lamp, the factory lamp, and the new pattern introduced last season—the nickel cylinder. The firm have successfully worked out the automatic distance-lighting of the lamps in series of any number.

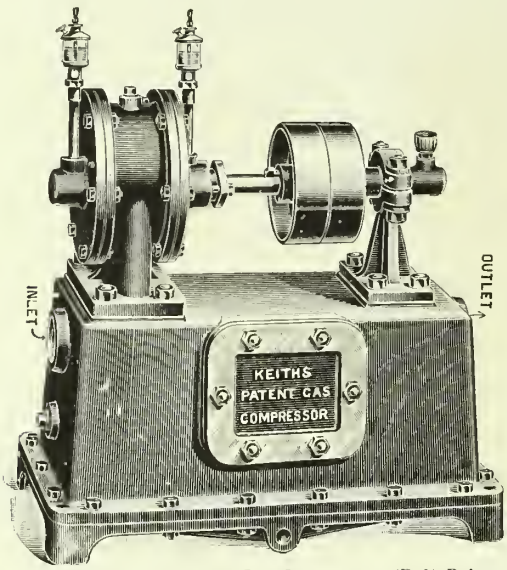
James Keith and Blackman Company, Limited.

This Company have attained a reputation in high-pressure gas lighting, which they have maintained by character and result of succeediug installations. The newest thing they have to show this year in connection with high-pressure plant is the Keith patent rotary gas-compressor. Where pressures of between 8 and 12 inches are required, the Company's original water-seal compressors answer perfectly; but there has lately arisen a demand for higher pressures than the water-seal compressors are capable of giving. Hence the new form of pressure-raiser. The following is the makers' description of the apparatus: "It consists of a positive rotary blower mounted on a cast-iron box base; the base containing an automatic pressure-regulating device. The blower has been specially designed for use with gas, and to give a steady delivery without pulsation. It is fitted with four blades having provision for automatically taking up wear. The lubricating arrangements have been designed with a view to making the apparatus suitable for unskilled attention; and the sight-feed lubricators used are gas-tight, and capable of working against pressure. Any surplus lubrication is discharged into the base, and can be drawn off at the bottom. The base has separate compartments for the low and high pressure gas, to which the gas supply and discharge are respectively connected. The pressure-regulating valve is fixed inside the base, and can be set to any pressure desired up to 5 lbs. per square inch by means of dead weights. Besides regulating the pressure, it returns all surplus gas from the high-pressure to the low-pressure compartment. It is extremely simple, and yet so sensitive that the pressure remains constant whether the full output or only a small quantity of gas is being used."

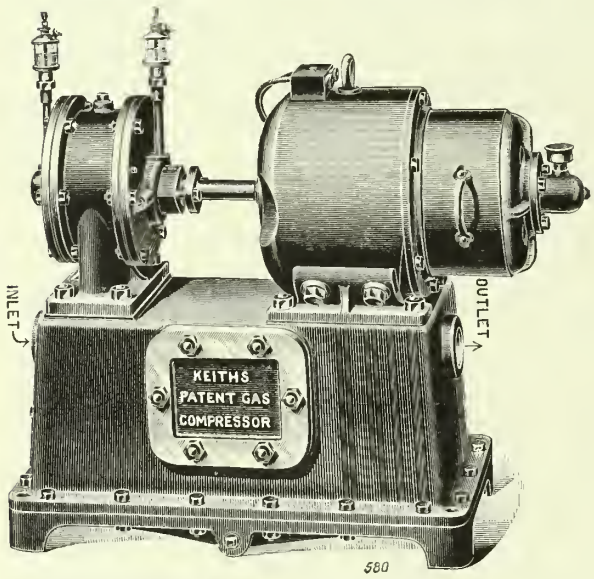
It is worthy of note that this apparatus is self-contained and complete as illustrated; the regulating-valve (wholly enclosed) preventing leakage or tampering with by unauthorized persons.

The compressor can be adapted to any form of driving; the

illustrations showing belt and electrical driving. It is made in five sizes, ranging from a maximum capacity, in cubic feet per hour, at 20 inches pressure, of 500 cubic feet up to 8000 cubic feet. The 500 cubic feet size only occupies a floor-space of

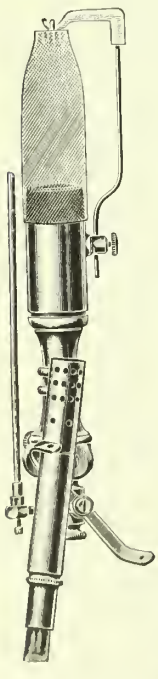


The Keith Patent Rotary Gas Compressor (Belt Driven).

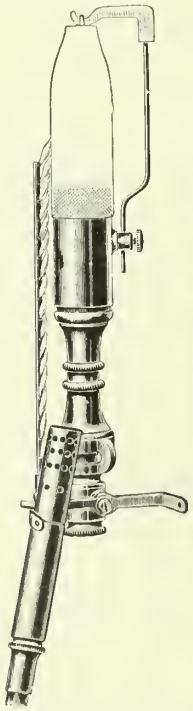


The Keith Patent Rotary Gas Compressor (Electrically Driven).

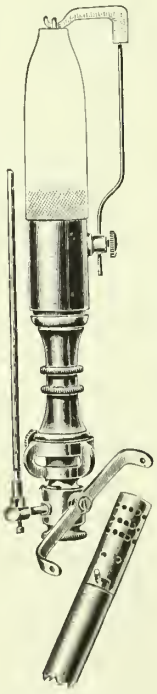
23 in. by 12 in., and the 8000 feet one 48 in. by 29 in. Where floor-space is a matter of importance, the small size of the rotary compressor will be appreciated.



Climbing Bye-Pass Cock—in Off Position, with Torch Engaging for Turning On.



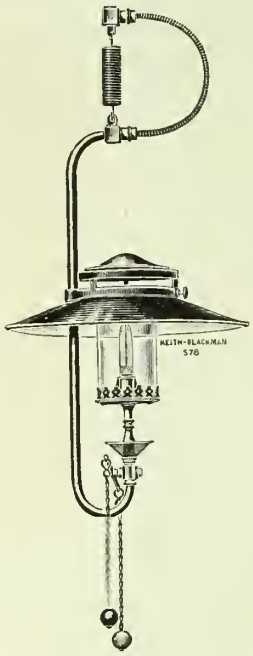
Climbing Bye-Pass Lighting the Burner.



Cock full on, Burner Lighted, and Bye-Pass Off.

Lighting Torch, with Protection Cap Removed.

Supplementing the large variety of fittings the Company have specially devised for high-pressure lighting, is a 75-candle power reflector fitting, as in the annexed illustration. The suitability of this fitting for factory and workshop purposes is obvious. It is furnished with an air-adjuster and dust-protector, a clear glass mantle protector of heat-resisting quality, a 10½-inch enamelled steel reflector and cowl, and an anti-vibrator made under license of the A.V.I.L. Company. The consumption of gas is from 2 to 3 cubic feet per hour; and the efficiency is 30 candles per cubic foot. Unless otherwise instructed, nipples passing 2½ cubic feet are supplied—the illuminating power thus being 75 candles.

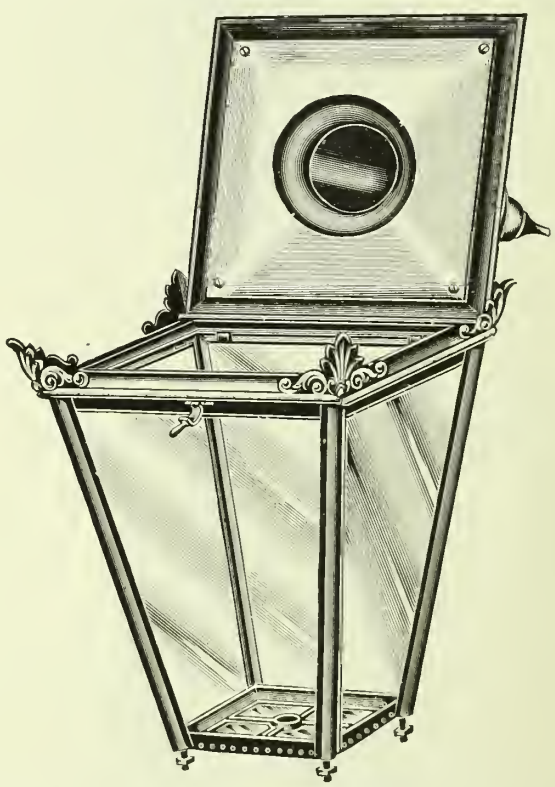


75-Candle Power Reflector Fittings.

The Keith patent flashing bye-pass cocks and electric lighter cocks are old friends; but this season the Company have a climbing bye-pass cock (illustrated), which does not require a pilot light, and overcomes the difficulty raised in some cases by the Insurance Companies. All that is required for each burner is the fitting; and a torch, in the hands of the man responsible for the lighting and extinguishing of the burners in large premises, does the rest. Description is unnecessary, in view of the illustrations. One advantage of this system of lighting, in places where a torch or taper must be used, is the preservation of mantles and the prevention of the smoking of the glasses and reflectors. The torch applied in the manner illustrated ignites the gas at one operation.

Messrs. Silcock and Tongue.

In connection with street lamps for incandescent gas lighting, Messrs. Silcock and Tongue claim that they have produced a lantern that is "far in front of anything yet put on the market." It is, in fact, quite the latest thing; being made of copper with a

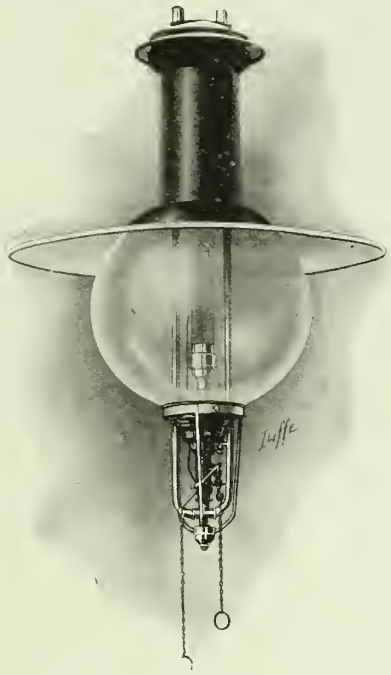


A Street Lantern for Incandescent Lighting, with Hinged Top for Cleaning, &c.

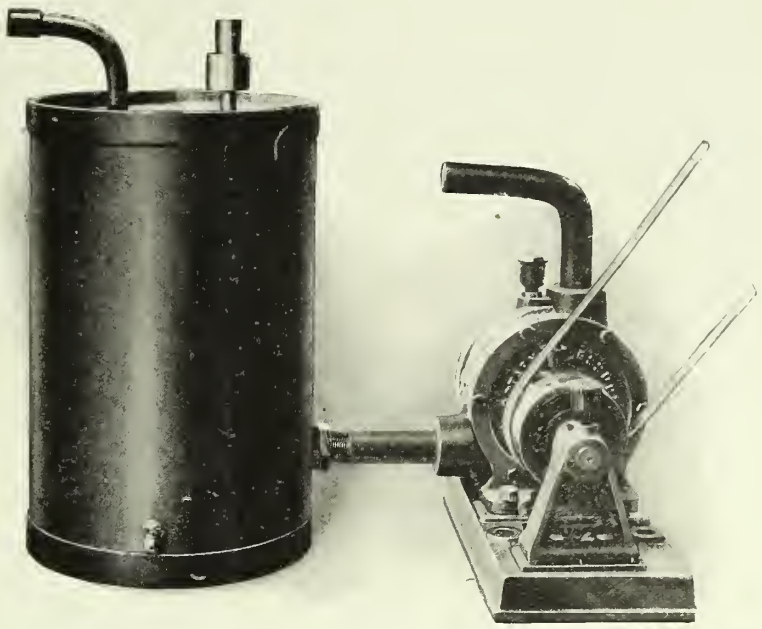
copper dome top, windproof head, and convex porcelain reflector inside, which throws all the light down. The top part is hinged, and opens straight back for cleaning, for getting at the burners, &c., and is fastened on to the front top bead with a neat thumb clip, as shown—thus doing away with the ordinary side door, and preventing a direct draught on to the mantles when cleaning. A quarter of the bottom of the lamp is a trap door for lighting.

United Kingdom Lighting Trust, Limited.

Some time since we published in the "JOURNAL" a complete description of the high-pressure lighting system of the United Kingdom Lighting Trust, Limited. In this case, it is the air and



Dust-Proof U.K. High-Pressure 500-Candle Power Lamp.



U.K. Blower, attached to Air-Reservoir, fitted with Governor.

not the gas that is compressed. The chief novelty that the Company have introduced for the present lighting season is a new lamp for dusty places, so arranged that none of the ordinary atmospheric air can enter it. Their system of high-pressure lighting peculiarly adapts itself for such a lamp, as it is only necessary to tap the compressed-air main which feeds the bunsen, and introduce a small pipe into the globe of the lamp. By this means, the compressed air is conveyed to the burner direct from the compressor, which may be situated at any convenient distance away. The lamp has been tested in foundries, mills, and every place that could be thought of where there is a large amount of dust in the atmosphere; and we are informed that it has given notable results in every case.

The next improvement is a 90-candle power inverted burner, which consumes only 3 cubic feet of gas per hour, and has been specially designed for use in mills or machine-shops where a number of small units are required. A further feature this season is that the Company's system has been adapted for use with a blower, to be run from ordinary shafting, hot-air engine, or electric motor, in places where a large number of lamps are required. The Company have also adapted the compressed-air system for heating—to laundry irons, laundry rollers, enamelling stoves, gas-stoves, &c.; and in many cases, we are assured, they make a saving of as much as 42 per cent. of the gas previously used to obtain the same heat.

[Other notices will appear in subsequent issues.]

A BUTTRESSED CONCRETE DAM.

The Beacon reservoir, part of a gravity system of water supply, is situated just above West Point (N.Y.), but on the opposite side of the river, on Mount Beacon, some 1200 feet above the high-water level of the Hudson River, immediately behind the village of Matteawan. It was built for storing and furnishing a portion of the water supply for Matteawan, Fishkill-on-the-Hudson, the New York State Hospital at that place, and some important manufacturing establishments. A storage reservoir is, of course, calculated to equalize the run-off from the watershed and the variations in the quantity of water flowing in the stream, so as to produce, as far as practicable, a sufficient supply the year through. The capacity of a storage reservoir, to be completely efficient when situated on a moderate or small stream, should amount to the daily consumption multiplied by the probable number of summer and autumn days during which the stream will be practically dry, or at least very much lower than the needed supply calls for—that is, during the hot months of August and September certainly, and perhaps during July and October as well—so as to provide against the actual use and waste of water, besides the evaporation and whatever, if any, unavoidable leakages there may be from the reservoir itself and its conduits.

Moreover, the matter of spillway, where the heavy rush of storm water is far above the ordinary flow of the stream, needs careful attention; and, though the average rainfall per annum for the part of New York State under consideration is only about 48 inches, it will be necessary, for safety, to provide spillway capacity for an impounding reservoir sufficient for the easy accommodation of the greatest quantity of water possible to reach such a spillway at any time. This necessity was dramatically illustrated in a rather startling manner a few years ago at this dam, when, in its form of construction previous to its present rebuilding and enlargement, the entire length was overtopped by a flood of storm water from an extremely heavy thunder shower, commonly called a cloud burst. In the reconstruction and increase in the height just finished, the new spillway was calculated for the heaviest known rainfall upon the watershed, was doubled in length, and was made about four times as deep as before; so that in all probability the area of watershed available will be fully accommodated under the most extreme circumstances of storm water and run-off.

The watershed of the Beacon reservoir, on account of its lofty situation, is of so moderate an area that there is a limit to the profitable dimensions of the dam; but from the short and rapid run-off, the rock nature of the watershed surface, &c., it is no doubt safe to calculate upon 65 per cent. of the rainfall as available for collection in the reservoir. The water falling as rain upon the surface of the reservoir to the amount of 100 per cent. would not quite cover the evaporation for a low year, and the low year with corrected evaporation will yield a storage of 103 million gallons. For the average year there will be a yield of 134 million gallons from the watershed, and about 2 million gallons over and above the evaporation from the surface of the reservoir—making 136 million gallons of water available for an average year.

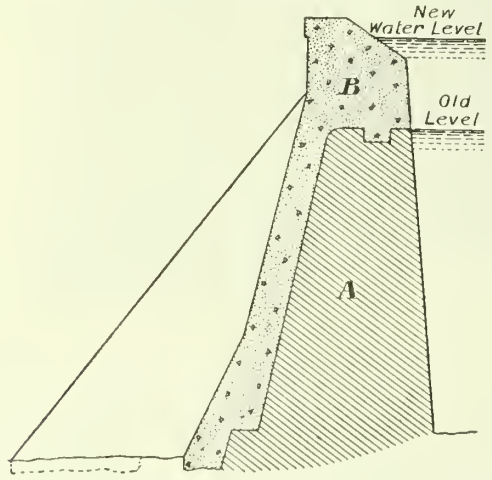
The above figures indicate that the original height of the dam, which was 23 feet above the bed of the stream, was about 6 inches higher than was actually necessary for the lowest record of rainfall, was more than 4 feet too low for the collection due to the average record of rainfall, and could be filled, if it was 12 feet higher than it was originally built, at the high record rainfall of 63·51 inches in the year 1888. The Beacon is a reserve supply calculated to fill between November and the following July, against the time when the other gravity supplies of the system fail in the summer months; and it must be considered that it is not necessarily emptied every year. Therefore the dam could be higher than the figures actually indicate for a complete filling, especially as a wet season preceding and succeeding a dry one would give a larger storage than the average; and with even two dry seasons successively, a very large storage at the start would be of great advantage.

Considering all the facts, it was deemed good judgment, in concluding how much higher it would pay to build the dam for the accommodation of this rather limited watershed, to take advantage of the average rainfall in excess of 48 inches (this being the average for 33 years) as a basis for calculation; and it was found to amount to 54 inches. Then allowing for evaporation, it was determined that the dam could be raised 7 feet—giving a total storage of 186 million gallons, including the new slopes to be covered by the rise of the water level. Therefore the plans and specifications were prepared for an increase of 7 feet above the original height of the crest, and made of sufficient resisting power to permit of still further height being obtained in case it was found that the run-off from this unusually rocky and impervious watershed proved to be a still greater percentage of the rainfall than had been allowed for.

The diagram on next page (which, with the descriptive particulars, has been taken from "Engineering Record") shows in the diagonal shading A, the typical or full section of the original dam, built of trap-stone quarried near the site. The portion B of the figure, indicating concrete, shows the addition to the dam in its fullest section, and also an outline, C, of the buttresses. It will be noted that there is a groove or dovetail cut into the top surface of the original dam, to provide a cut-off for the water, and also

to completely lock the old and new work together; also that the outer edge of the older dam is rounded, to add strength to the concrete jacket at this point.

The original stone dam was built probably more than twenty years ago, and was located upon a solid rock foundation bed, the rock extending well up the slopes at the ends of the dam—in fact, to a sufficient height for the safe support of the new work. The original spillway was simply a shallow notch of very moderate length formed through the crest of the dam near the middle of the length, and permitted the outflow to fall from the top to the bottom of the dam at its greatest height of section. The spillway for the new work is of liberal dimensions, and is situated at the easterly end of the dam, where the fall of outcoming water is comparatively little, and where a natural rock bed forms an excellent passage-way for storm water coming over the spillway down to the stream bed below the dam.



The new concrete structure is about 350 feet long and 33 feet high at its greatest depth of section; the depth of the water immediately behind the dam being about 30 feet. The peculiar buttress design was suggested naturally enough by the extremely high cost of material delivered on such an out-of-the-way site. The prime object was to reduce the amount of materials to the lowest terms; the labour, being quartered upon the premises, being scarcely above normal. Materials such as cement, sand, crushed stone, and lumber, at the ordinary points of rail and water delivery, were reasonable enough in price; but transportation to the site was nothing less than heroic in character, and brought up considerably the cost of these materials.

In round numbers, the total of the estimate was $23,000, and the contract was let for about 7 per cent. less. The estimate was made in the spring of 1904, just after prices of all kinds of materials had begun to fall. They have gone much higher since that time; but even at present prices the cost above given would probably be safe. Considering the difficulties of transportation up a grade of 1200 feet within two miles, the contract price for the work was considered quite satisfactory—to the buyers at least. A part of the saving on the cost of the dam was probably due to the fact that the successful bidder calculated upon taking a stone crusher up to the work, which he did; and as the trap rock was obtained upon the premises without any cost to him, he also saved the cartage upon a good many tons of material, bearing only the small expense of operating the crusher.

The Late Mr. Henry Finlay's Estate.

The late Mr. Henry Finlay, who was, until the amalgamation with the South Metropolitan Gas Company, Engineer of the Surrey Consumers' Gas Company, and whose death was recorded in the "JOURNAL" for the 27th ult. (p. 564), left estate valued at £212,583 gross, with net personalty £212,343. The Executors of the will are Mr. William Franklin Gardner, retired bank manager; Mr. Richard Laurence Andrews, of the London City and Midland Bank, Cornhill, E.C.; Mr. Frederick Robinson, accountant; and Mr. Francis Charles Collingwood, of 4, St. Dunstan's Alley, E.C., cashier, to each of whom the testator left £1000. He left all his shares in the London City and Midland Bank to Mr. Andrews, £2000 stock of the South Metropolitan Gas Company and five shares in the Hope Lighterage Company, Limited, to Mr. Robinson; to Mr. Frederick William Church, Secretary, Mr. John Gow, head foreman, and Mr. Thomas L. Archer, 25 shares each in the Gas-Meter Company; to each clerk in the same Company at the Kingsland Road branch the testator left £10; to Richard Rapkin, the Manager of the Hope Lighterage Company, Limited, £100; and £300 for distribution among the counter cashiers and coupon clerks at the Cornhill branch of the London City and Midland Bank. Mr. Finlay gave £1000, 50 preference shares in the Gas-Meter Company, and enough furniture to furnish two rooms, to his cook, Ann Smith, if in his service at the time of his death. He also bequeathed £1000 to the National Lifeboat Institution, for the purpose of building a new boat to be called the "Henry Finlay," to be stationed on the south-west coast of Scotland; and £500 each to 22 hospitals and other charitable institutions. The testator left the residue of his estate to Mr. R. L. Andrews and his wife, absolutely.

WATER SOFTENING AND HARDENING.

In the notice of the proceedings at the Fourth Engineering Conference which appeared in the "JOURNAL" for the 25th of June, it was mentioned that two papers dealing with the above subjects were submitted in the Water-Works, Sewerage, and Gas-Works Section.

The paper on "Water Softening" was by Mr. William Matthews, of Southampton, who began by pointing out that water for domestic purposes can, by the use of lime alone, only be softened to the extent of reducing the temporary hardness due to carbonates of lime and magnesia; the removal of permanent hardness requiring the use of other and objectionable reagents. The reduction of the carbonate of magnesia is attended with additional cost, as the quantity of lime used is greater; and, the chemical reaction being slower, the plant has to be laid out upon more liberal lines.

The author went on to say that the problem involved in softening *per se* is purely chemical; that of the subsequent clarification being mechanical and largely dependent upon the physical character of the precipitate resulting from the chemical process. To obtain the best results, the crystals forming the precipitate must be as large and regular sized as possible, to ensure which the lime water must be completely saturated and free from all suspended and undissolved particles, and the water to be softened must be equally clear and free from inert insoluble matter. The mixing must be in proper and unvarying proportions, and accomplished in such a way that, as far as practicable, each particle of water receives its individual dose of lime water. If the admixture takes place in tanks containing the precipitate thrown down in previous operations, the reaction between the lime water and the hard water cannot but be imperfect and unduly delayed; while the expenditure for lime is increased and larger tank capacity is necessary.

Ordinary builders' lime is useless for softening purposes; it must be hard-burned and practically free from alumina or siliceous matter. The lime obtained from chalk of at all a marly character must be studiously avoided, or the solution obtained will be found to contain a large percentage of hydrate of alumina in place of lime, and will lead to disastrous results.

After hydration, it is desirable, in anticipation of subsequent stages in the process, to convert the lime into the form known as cream of lime, by adding softened water in a standard proportion, passing it through strainers, and thus removing all the grit and *débris*.

The most approved way in which to create the lime water is to pass a stream of softened water through a tank or tanks into which cream of lime has been introduced; the flow through them being confined to so low a velocity that the water has ample time in which to become saturated with the lime, and does not carry up with the current any insoluble matter. By the adoption of this method, the regulation of the flow of lime water in the proper ratio to that of the hard water is rendered easy if two pumps be actuated by the same or each engine—the one pumping hard water and the other the softened water to be saturated with lime—as, no matter what variation in speed takes place, the ratio remains unaltered.

The mixture is best accomplished by allowing the lime water to fall in a thin sheet upon a similar sheet of hard water flowing under it. Between the operation of mixing and the commencement of the process of clarification there should be a time-interval varying from at least half-an-hour to a longer period, according to the amount of carbonate of magnesia in the water.

There can be no doubt that clarification can, in most cases, be best effected by filtration, as the plant required takes up a minimum amount of room, can be worked continuously, and be added to from time to time by small units, and is economical, while giving the best results.

The filtrate is formed in the first instance by allowing the softened water to pass through cotton cloth mounted on suitable perforated frames. The cloth arrests the crystals of the carbonates, which, becoming piled together, form a fine screen and filtering medium; hence the importance to be attached to their size and regularity. Upon the layer of precipitate reaching a certain thickness and the flow becoming correspondingly slow, the mass is washed off by means of water-jets and the filter started again.

To obtain good results, the head of water on the filters must be kept low and regular, and the outlets free, so that the cloths are not subjected to pulsating movement, such as that due to direct connection with a pump suction. The cleansing is best done by water-spray, arranged so that the jets, in passing across the cloth, pare the film of precipitate off them, and do not tend to drive the deposit into the pores of the cloth, as was the case in some of the earlier plants.

In conclusion, Mr. Matthews remarked that one of the great merits of the filtration system, when worked at a head which cannot be exceeded, is that by no manner of manipulation can the plant be made to pass more than its proper quantity of water, which must all be sent through the filters, and so be clarified. If the water is properly softened, and the necessary time-interval given for the completion of the reaction, there is no difficulty in filtration or danger of the subsequent formation and deposition of

precipitate in the pipes beyond the filters. But neglect of these precautions has given rise to much trouble and disappointment. In a notable case, where magnesia was present in rather large quantities, the blocking-up of the cloths became very serious, and was, in the author's opinion, due to the fact that, when the precipitate reached the filters, carbonate of lime crystals were deposited in the ordinary manner. Owing, however, to an insufficient time-interval after mixing, the reaction with the carbonate of magnesia was incomplete and still going on while the water was passing through the layer of deposit already on the filter-cloth; the effect being that the smaller crystals of magnesia were deposited among the larger crystals of lime, as well as in the pores of the cloth, filling up the interstices much in the same way as sand is used with gravel for making concrete.

The paper on "Water Hardening" was by Mr. James Watson, the Water Engineer to the Bradford Corporation. Having offered a few remarks on the well-known Clark system of softening water, the author said that water hardening—the antipodes of water softening—is a comparatively modern practice. In the softening process we apply lime to get rid of lime; in the hardening process we follow generally the same method by adding lime to waters in which lime salts are either wanting or are only found in abnormally small quantities.

Soft-water supplies are absolutely essential to the industrial life of many of our great centres of population, and probably no less so in securing the comfort and economy obtained from its use in the houses and homes of the people. Soft water has, however, under certain circumstances, one drawback—viz., it possesses lead-dissolving properties, and plumbo-solvency is far from uncommon as the result of its distribution. Such a state of matters was admittedly more or less dangerous to health, and the realization of this fact may be said to have been the initial cause of hardening water in order to counteract acidity and neutralize peaty water possessed of the lead-dissolving property.

In the Thornton Moor drainage area of the Bradford Corporation, a good deal of the land is of a peaty and boggy nature; and about seventeen years ago it was found that at times, especially after a flood, the water was acid, and acted on lead. The reservoir contains 175 million gallons, has a top-water level of 1241 feet above the sea, and is supplied from a high moorland drainage area 1260 acres in extent. The geological formation is millstone grit. The rains saturate the peat, and the water in the reservoir is often found to be acid.

The following analysis, made in the early days of hardening—viz., in 1892—shows the character of the untreated and treated water. The samples were treated with the view to determine the change made in the natural water by the method adopted (which had been in operation for some time) for remedying the solvent action on lead pipes, and to ascertain to what extent the character of the water was altered by "hardening." The results are given in grains per gallon. The reservoir water was found to have an acid reaction equal to 0·1 grain of sulphuric acid per gallon.

—	1	2	3	4
Total solid matter .	5·8	7·00	7·40	6·80
Lime (CaO) . . .	0·9	1·23	1·20	1·23
Hardness	1·5	2·30	2·40	2·30
Lime equal CaO (carbonate of lime).	1·6	2·20	2·22	2·20

1. Natural water from reservoir, untreated. 2. Water after treatment by adding 3 grains of carbonate of lime per gallon. 3. Treated water taken from the surface of one of the filter-beds. 4. Treated water after filtration through sand.

Many samples of water from the same supply, untreated and treated with chalk, were kept in contact with bright lead, and gave the following results:—

—	A	B	C	D
Grains of lead per gallon .	0·27	None	0·30	0·03
Days of contact	63	100	62	62

Samples A and C were untreated; samples B and D were treated.

Many experiments were made to ascertain the saturating-point; and it was found to be 3 grains per gallon. As a rule, less than this quantity did not show satisfactory results, and double had no better effect. The addition of 3 grains of chalk per gallon, applied with regularity and precision by the machine hereafter described, had the effect of preventing the lead-dissolving action of this water; and complaints as to water containing lead have been absent from this zone of supply for the past sixteen years.

The chalk used for hardening water is prepared in the following manner: The limestone is obtained from the quarry by blasting the rock, which is then sent to the mills, and there broken by hand into cubes of about 3 inches. These are shovelled into the wash-mill, which contains two heavy edge-runners to crush the chalk—a continuous supply of water being added in the grinding process. The resultant combination of lime and water is then passed into sand-pits, which collect the coarsest of the material, from which it is levigated into settling-tanks placed behind each other, and connected so that the material passes from one to the other over a series of five or six pits. The first pit receives the larger deposit, the second a smaller deposit, the third smaller still in deposit and finer in quality, and so on throughout the whole of its travel from the first to the last pit. When removed from the pits, it is taken to the ovens to dry. This requires 20 to 24 hours, after which it is ready for use. The finer and the richer in pure carbonate of lime the material is, the better is it suited for the hardening of water for water-works purposes.

The machine previously referred to is housed on the floor above the chalk-store. The chalk is conveyed by rope and pulley to the hopper, which holds a quantity equal to 12 hours' supply of the largest quantity of water to be treated; and when working at the maximum, it is filled every morning and night, beyond which no further attention is needed. The chalk passes from the hoppers to the rollers of the mill, passing through the rollers in a fine film or sheet of powder into the mixing-churn, where a revolving-shaft, with agitator arms attached, makes milk of lime, which in turn is delivered into a trough, where it mixes with the untreated water. The treated water is then conveyed by the filter-bed canal to the filter-beds, and passed through the sand filters at the rate of 380 to 400 gallons per square yard of filter area per day. The machine is driven by a small water-wheel, the feed of which can be regulated within limits to a constant speed of revolution. This, in turn, operates the rollers and the agitator, which can be set and kept at any desired speed. The upper roller can be set at any distance apart from the under one, the aperture being regulated by screws; and any number of grains per gallon can be sent to the untreated water by adjustment of the rollers, which when once set remain constant and regular in the delivery of chalk.

The works have been in operation night and day for sixteen years, require practically no attention, and are serving, and have served, the purpose for which they were erected—viz., to harden an exceedingly pure and soft water. The machine described was the first of its kind to be used for the accurate application of lime for the hardening of water.

Use of Tar Oils in the Diesel Motor.

A recent number of the "Zeitschrift des Vereins Deutscher Ingenieure" contains a report by Herr P. Rieppel, of Nuremberg, on some experiments on the use of tar oils for driving motors of the Diesel type, which were carried out in various commercial laboratories in Germany as well as at the Technical High School in Berlin. From the results then obtained, it would appear that: (1) Brown coal-tar oils can be used in the Diesel motor; but ordinary coal tar oils can only be employed after suitable treatment. (2) No useful information as to the value of an oil for the purpose in view can be obtained by ascertaining its specific gravity, viscosity, flash point, firing point, or calorific value. (3) On the other hand, a determination of the proportion of hydrogen by ultimate analysis is of fundamental importance, as it enables the investigator to find out the quantities of aliphatic or aromatic hydrocarbons present. (4) Self-ignition and combustion are the more likely to occur, the more suitable the oil is for the production of oil gas—that is to say, the greater the volume of gas it yields at a comparatively low pressure and low temperature. Ordinary tar oils require a larger amount of heat to be impressed on them, or a longer gasification period, than brown coal tar oils. (5) It may be considered that all motors consuming liquid fuel can be divided into two kinds. The first of these—*e.g.*, the Diesel and the Haselwander—are distiuguished by the fact that the oil is sprayed in when the engine reaches its dead-centre, oil gas being formed at once and no method of artificial ignition being employed; the second are the true explosion motors, where a mixture of oil vapour and air is inflamed by artificial means without intermediate production of oil gas. The latter definition shows the way in which anthracene and creosote oils may be rendered utilizable in the Diesel motor. The plan requisite consists in powerfully heating (perhaps only at one spot) the space in which the compression occurs—that is, in imitating the conditions of the explosion engine proper. A Diesel engine run on these lines has worked for weeks at a time on a cheap tar oil in a factory at Nuremberg, and borne variations in the load, from zero to full power, without giving any trouble.

A gas-engine test lasting two weeks was recently run at the works of the J. P. Eustis Manufacturing Company, of Boston, by Messrs. P. R. Nichols and R. F. Knight, of the Massachusetts Institute of Technology. The test was made on a 55 H.P. engine direct-connected to a 30-kilowatt direct-current generator. The engine was of the vertical twin-cylinder four-cycle type, the governing being effected by varying the richness of the explosive mixture. Cooling water was circulated by a motor-driven centrifugal pump; and the engine was started by compressed air stored in two tanks, which were kept filled by an air-pump driven by a small motor. The gas used by the engine was taken from the street mains, and averaged about 590 B.Th.U. per cubic foot. During the two weeks' run, the total kilowatt-hours were 3146, and the total gas used was 92,900 cubic feet; 31·9 kilowatt-hours were used in driving the pump, leaving 3114 as the net energy delivered during the run. At 70 c. per 1000 cubic feet, the gas cost 2·09 c. per kilowatt-hour; the oil, 0·029 c.; the labour, at two hours per day, 0·193 c.; and the interest and depreciation, reckoned at 15 per cent. on $3000, amounted to 0·555 c.—making the total cost of energy 2·87 c. per kilowatt-hour.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Gas-Heating Business Field.

SIR,—The article in your issue of the 3rd inst., emphasizing the desirability of the extended use of gas-fires, tends to make the subject a prominent one. As you suggest that readers may have something to say upon the subject, it has occurred to me to venture a few remarks thereon.

It may seem somewhat ungracious to take exception to your statement that the methods adopted by municipal undertakings have not provoked your admiration. At the same time, the methods advocated by you have been in some cases already in use by municipal undertakings for many years.

You advocate differential prices for lighting and heating; but my Committee have for a great many years adopted this. They have also continuously advertised gas-stoves enormously; assisted at lectures and demonstrations on gas cooking and heating; and have spacious show-rooms available at the gas-works and in the centre of the town. At the present time the price for lighting is 2s. 3d. per 1000 cubic feet and for heating 1s. 6d.—both subject to 5 per cent. discount. Surely a difference of 9d. would be thought sufficient. All gas fires and meters are fixed free of charge to the consumer at a trifling rental for whatever pattern gas-fire is selected. Yet, with all this enterprise, the fact remains that there has not been any extensive adoption of gas-fires in the town.

One is lead to inquire what are the principal causes of the non-adoption of gas-fires upon an extended scale. It is known that the medical profession are frequently unfavourable to their use. This opposition can only be overcome by education and experience upon this point, and will adjust itself.

The assistance of architects is much needed, in order that adequate provision for gas-fires may be made in new buildings. In some bedrooms, miserable little register stoves are found—unsuitable for any purpose; and the addition of a gas-fire projecting in front of the grate is not an improvement. If a suitable recess had been made, and pipes laid in the first instance, the case would be altogether different. The projection of a gas-fire into many small rooms, coming into close proximity to the bedstead, is undesirable.

Gas-fires ought not to be made simply as a correction or an addition to a coal-fire register, but ought to be arranged for in the original design. It looks objectionable for a gas-fire to be placed in front of a coal-fire grate.

A modern grate adapted for a gas-fire in the first instance would do much to popularize the use of gas for heating in drawing-rooms, &c.

The principal hindrance has hitherto been the inefficient design of gas-fires available, and not from lack of commercial enterprise in the matter. When a really efficient and economical gas-fire is available, the development of the heating business will speedily follow.

EDWARD A. HARMAN.

Huddersfield, Sept. 11, 1907.

SIR,—It was with great pleasure I read your editorial and the letters from Mr. R. G. Shadbolt and others dealing with the above subject; and I most heartily endorse the points raised.

It has long been a matter of wonder to me why the gas companies in this country, in these days of fierce electric and power gas competition, have not made an energetic bid for the vast field awaiting development in the matter of gas heating. Whatever might have been urged years ago in favour of being gas lighting companies only—to which so many names testify—these arguments certainly do not hold good now, and will hold less and less as the years go by. The period of a more or less beneficent monopoly has gone; and the days of low illuminating power, cheap gas, and commercial methods have come. And well will it be for those who have the foresight to read the signs of the times, and to act in accordance. It is a matter for general comment that, while in the majority of houses there is now installed a gas-cooker, only in the minority is a gas-fire seen—and then possibly not more than a single one.

The commercial principle at stake in obtaining a footing against competitors, is to be able to give a better article than any previously in use. This has been well exemplified in the case of the cooker; and upon it, it solely has made its triumphant way. The (1) convenience, (2) saving in labour, and (3) general economy of the cooker are most obvious to all; and if the field of heating is to be attacked, the same principle must be observed. The gas-fire possesses, in common with the cooker, the first two essentials. That it has failed on the third is, however, common knowledge; and the fact that many thousands of stoves are hired out during the winter season does not invalidate the point, inasmuch as they are promptly returned as soon as the circumstances that called them forth have passed—thus clearly inferring that they are of value only against exceptional conditions. If their appreciation and value were fundamentally sound, they would be retained, the same as the cooker and the gas-fittings.

The reason that the gas-fire fails on the third point, is that it has not yet been clearly recognized that it is a fuel consumer pure and simple, and as such has to compete with other fuel users, and therefore has nothing in common with lighting principles or practice. Until that is recognized in this country—and it is high time that it was—and means are taken to enable it to compete on a fair basis against other fuel-users, the field will remain practically unworked. But so soon as prices are adjusted, I am certainly of opinion that no difficulty will be experienced in greatly improving the financial position of gas undertakings.

The capital outlay on extra meters need not be seriously considered, as there are to-day specially-made small meters of a rotary type to meet the case, whose cost is so low as to prevent any anxiety on this point. As one officially connected with a large foreign gas company, I can speak most positively as to the benefits accruing, and accruing only to the system of differential prices of gas, coupled with the use of these small meters, applied to the purposes named; and I see nothing to prevent a similar success here. Treating a consumer's meter in the same manner as our electrical friends treat their watt meters, where is the gas manager who is content with the load-factor so exhibited?

COMMON SENSE.

Sept. 14, 1907.

SIR,—I beg of you to accept my best thanks for the reassuring article, on differential prices, which appeared in your issue of the 4th inst.

In common with many other investors in gas stocks, I was very uneasy some years ago when the electric light first made its appearance as a real competitor with coal gas. But thanks to the able and vigorous speeches of the Chairman of the South Metropolitan Gas Company, *re* the customers of the artisan class which would be added to the then customers, by the adoption of the prepayment system, I fortunately held my hand from selling out.

Again the time appears to have arrived when a new stimulus is required for the continued success of the gas industry; and as foreshadowed by your article, and by the speech of Mr. Whiteley, the Chairman of the Bournemouth Gas Company, this field is in the direction of domestic heating.

STOCKHOLDER.

Sept. 10, 1907.

SIR,—I am a manufacturer of gas apparatus, an investor in gas stock, and use gas for both light, heat, and power.

Mr. Shadbolt's letter in your last issue puts in a nutshell the common-sense policy that should be adopted. It is not at all necessary in the majority of cases to tamper with the price of lighting gas; it is already cheap enough. It is not a question of whether the margin of profit allows it. But it is a question of competition; and if the heating field has to be obtained, I am of opinion that differential prices must be adopted to bring gaseous fuel nearer the price of solid fuel.

C. S.

Sept. 13, 1907.

SIR,—I am interested in gas companies, not only as a shareholder but as a consumer, and read with much satisfaction your article about the large scope there is for gas-fires.

My own case is simply typical of a great number of gas consumers. In every room in my house (except the general living-room and the day-nursery) a gas-fire is fixed; and there would be one in each of these rooms also if I could gauge with any degree of certainty how much gas I should be likely to use during the year, and if my gas company would encourage me to use them by either granting me a rebate, or charging me on a lower scale for the gas so used. Up to the present, however, the company do not seem to care whether I use coal fires or gas. The former, under present conditions, are cheaper than the latter for extended use—notwithstanding the dust and labour in connection with them. But perhaps, as the price of coal seems to be going to unknown heights, the gas company will wake up and offer some inducements to would-be users of gas-fires like myself.

A CONSUMER IN THE SOUTH.

Sept. 13, 1907.

Gas from Straw.

SIR,—I have read with much interest the paragraphs, *re* "Gas from Straw," in last and this week's issues of the "JOURNAL."

It brings back to my recollection making gas from megass (crushed sugar-cane) a good many years ago, when I was Engineer and Manager of the Georgetown Gas Company, Demerara, and at the time was acting as Consulting Engineer for three large sugar factories.

After the cane is crushed in the mills, a certain percentage of the juice is left in the cane, which with the fibre, produced a big make of gas of about 4-candle power. At that time the duty on oil was prohibitive, as Georgetown is a wooden-built city; and the duty was kept high, by pressure on the Government by the local Fire Insurance Companies.

Had it been possible for me to procure oil at a cheap enough rate, I would have gone further into the matter of making good saleable illuminating gas with megass and oil.

THOS. B. YOUNGER.

Chesterfield House, Great Tower Street, E.C.
Sept. 12, 1907.

Gas Explosion at Bideford.—An explosion which did considerable damage took place yesterday week at No. 6, Torridge Place, Bideford. Mrs. Mills, the wife of the occupier, discovered a smell of gas when she got up in the morning, and on going into the sitting-room on the ground floor appears to have struck a match. An explosion resulted, which blew out the windows, broke down part of the ceiling, and threw Mrs. Mills to the ground and burnt her severely. A second explosion immediately followed in the kitchen, where a gas-stove was lit. This also did considerable damage to the premises. It was discovered that the escape of gas was due to the evaporation of the water in the slide of a chandelier in the sitting-room.

Self-Intensifying Gas-Lamps for Indoor Lighting.—A new scheme of lighting has been carried out by the Exeter Gas Company at the Victoria Hall, one of the most popular places of assembly in the city. For the illumination of the large hall, 16 of the latest pattern Welsbach self-intensifying gas-lamps are used. These are each of 500-candle power, so that the total is equal to 8000 candles; while the distribution is so arranged that every part of the hall is brilliantly and evenly illuminated. The lamps for the ground floor and the stage are all suspended by steel wire, and the gas is supplied through flexible metallic tubes. They can thus be raised or lowered or moved to any desired position. One tap controls the stage lights, and two taps the ten central lamps; and the whole or part of them can be turned on or down simultaneously or in sections. Though the lighting is so greatly improved, the cost will be less than half what it was under the old system; and the gas consumed will come to just over 1s. per hour.

REGISTER OF PATENTS.

Cooling and Washing Gases.

MEYER, A., and HASTERT, E., of Dudelange, Duchy of Luxembourg.
No. 18,014; Aug. 10, 1906.

This is a modification of an invention recently described in the "JOURNAL"—see *ante*, p. 578; and the same illustration that was then reproduced accompanies the specification of this later patent.

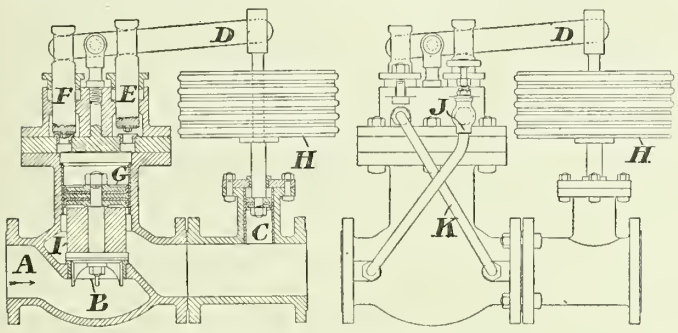
The apparatus referred to is characterized by the combination of a cylindrical vessel and a number of perforated plates or sieves for distributing the gas, which rotate on a horizontal shaft, and one or more series of perforated tubes arranged in such a manner that each plate is uniformly cooled by fresh water and each element of the sieve-surface is freed from dust by rotation.

In accordance with the present invention, the spraying of the sieves is effected by pairs of pipes arranged radially to the shaft, and provided with spraying holes in such a manner that the total surface of the sieves is completely sprayed by fresh water under pressure twice per revolution. In this manner, on the one hand uniform spraying is ensured, and on the other hand the particles of dust deposited by the gas upon the meshes are constantly carried away by the water; so that obstruction of the sieves is entirely prevented. As compared with known forms of apparatus, this apparatus is said to present the "important advantage that the total section is almost doubled, which corresponds to an increase of the output in the same proportion." Also as obstruction of the meshes is impossible, the employment of dismountable segments for the metal discs becomes superfluous.

Regulating Pressure in Pipes.

BROADHEAD, J. B., of Brighouse.
No. 18,460; Aug. 17, 1906.

This invention relates to that class of pressure regulators in which the movement of the valve controlling the pressure supply is itself controlled by the delivery pressure of the fluid acting upon a piston against the action of weights; and it is more particularly applicable to water-mains in towns where the pressure may vary considerably owing to difference in altitude. The apparatus is also applicable for controlling and regulating the pressure of steam or any fluid.



Broadhead's Pressure Regulator.

The inlet of the apparatus is at A; and when charging the main, the valve B opens by the pressure acting on the inlet side. The piston C is loaded with weights equal to the pressure on the outlet side; and when the desired reduced pressure on the outlet side is attained, the piston moves upwards, and lifts the lever D, which opens the valve E, and closes the valve F. The valve E being open, the pressure on the inlet side acts on the piston G—the water passing through the auxiliary pipe and valve J, which is always open except in case of fire. The weight I moves the valve and piston immediately the piston and valve are in equilibrium. The area of the piston G being larger than the area of the valve B, the pressure acting on the piston closes the valve; and it remains closed until such time as the pressure on the outlet side is reduced by a draw on the main.

When the pressure on the outlet side falls below the pressure for which the apparatus has been designed, the weights H overcome the pressure on the piston C, and the lever D falls and closes the valve E and opens the valve F. The main being now charged, the valve B is acted upon at both sides, but by different pressures. The pressure on the inlet side of the valve, combined with the reduced pressure acting on the underside of the piston G, opens the valve and displaces the water at the back of the piston through the valve F and pipe K into the outlet side of the main.

In case of fire, the valve J may be closed, which thus cuts off the supply of water from the inlet side to the top of the piston G—the initial pressure and full bore of valve being thus available for fire purposes.

Incandescent Gas-Mantles.

COXHEAD, G., of East Ham, Essex.
No. 18,602; Aug. 20, 1906.

This invention relates to gas mantles which have a catalytic material applied to them for the purpose of rendering them self-lighting upon the gas being turned on and which "obviate the many disadvantages generally experienced with the ordinary methods of lighting even when independent catalytic and other automatic igniting devices are made use of." The inventor claims that it is possible, from one given point, to control individually or collectively a whole series of burners, and thus permit of any or all the burners of a system being lighted or extinguished (or the light raised or lowered) at will.

He proposes to treat the mantle with the catalytic material during manufacture—that is to say, at the stage immediately following its impregnation with the illuminating salts he applies to a part of the mantle which will form one of the folds in the neck or gathered-in portion a strong solution of "a particularly active platinum black" which is then heated and dried and the process repeated. A thin line or streak of the platinum black is then drawn down the side of the mantle, extending from the spot treated as described to the ignition point of the gas, and the mantle is then finished off in the ordinary manner.

Gas Analysis Apparatus.

SIMMANCE, J. F., and ABADY, J., of Westminster.
No. 18,680; Aug. 21, 1906.

This invention relates to apparatus for enabling the volumetric analysis of a gas or gaseous mixture (with a view to the detection and estimation of certain constituents) to be performed by the well-known method of measuring off a definite quantity in a chamber of variable capacity, exposing same to the action of a suitable reagent, and re-measuring the residual gas also in a chamber of variable capacity—the difference between the volumes of gaseous mixture before and after the reaction affording a guide to the estimation (quantitative or qualitative or both) of the constituent sought.

Known forms of apparatus for effecting this operation, the patentees point out, comprise chambers of variable capacity (one of which is connected with the source of gas to be analyzed, while the other is connected with the first chamber and with an outlet) and means for subjecting the gas to the action of an absorbent reagent as it passes from the first to the second chamber. Moreover, it has been proposed to provide such apparatus with a venting device, for automatically limiting the pressure within the first chamber when the latter attains a predetermined effective capacity—consisting of a tube, one end of which is fixed to the first or measuring chamber, while the position of the other end is fixed in relation to a liquid seal which closes the end, so that the venting device is caused to act as such by the rise of liquid in the first chamber.

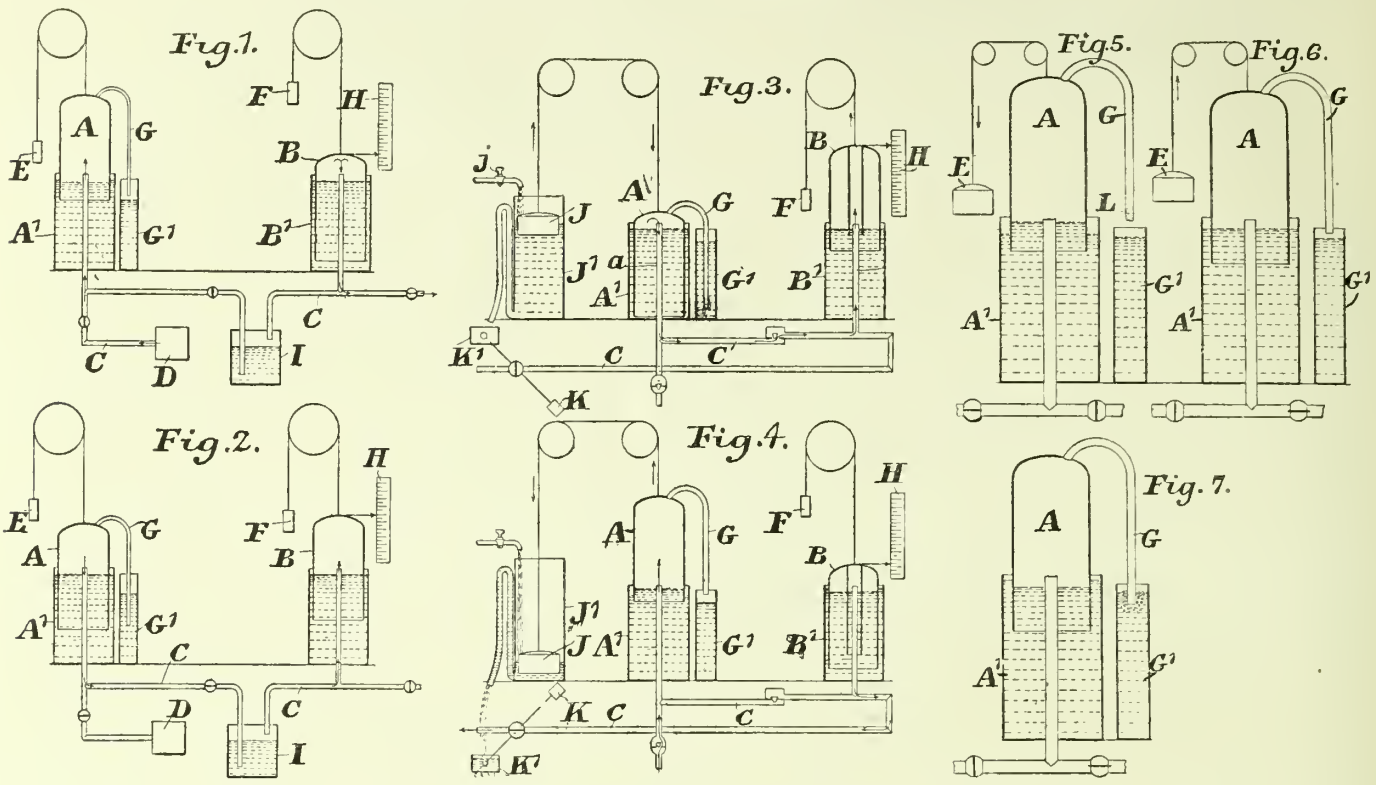
The more immediate object of the present invention is to provide (with a view to enabling the method just described to be carried out) apparatus of "extremely simple construction" provided with an improved device whereby a constant predetermined volume of the gas or gaseous mixture to be tested, whatever the pressure at which it reaches the apparatus, shall always and automatically be brought to a determined pressure—usually about that of the atmosphere—so that a series of volumetric tests, if performed under identical conditions as regards temperature, will yield results having a uniform degree of accuracy. A further object is to provide, in combination with the device just referred to, means for enabling the apparatus as a whole to be worked automatically.

The gas to be analyzed is first introduced into an expansible chamber in the form of a sealed bell provided with a venting device consisting of a tube communicating at one end with the crown of the bell, while the other or free extremity of the tube normally dips into a liquid seal whose surface level is adjustable, so that the pressure of the gaseous contents of the bell will be automatically limited when the bell attains a predetermined maximum effective capacity. The measured volume of gas at predetermined (usually about atmospheric) pressure, thus obtained, is thereafter passed, at approximately the same pressure, through apparatus wherein it is subjected to the action of an absorbent reagent; the residual gas which passes over from the reagent being received in, and causing a corresponding rise of, a second sealed bell provided with means for measuring the resulting increase in its effective capacity in terms of the volume originally introduced into the first bell.

The introduction of the gaseous charge into the first bell is effected by a pump actuated by hand or by some form of outside mechanical power—such as gear and weights, clockwork, chimney draught, water power, electricity, or the like. Thus, for example, the pump may be constituted by the first gas bell itself; this being caused to alternately rise and descend so as to alternately inhale and expel the measured volume of gas to be tested. The bell, in order that such movements may be performed automatically, may be connected to a float reciprocating vertically in a vessel which is alternately filled with liquid from a constant source of supply and emptied automatically by syphonage. The discharge of the syphon may serve also to operate a valve which controls the waste outlet of the second bell, so that the action of the apparatus as a whole is automatic.

Figs. 1 and 2 (p. 774) represent a rudimentary form of the apparatus at two stages of the operation. Figs. 3 and 4 show similar apparatus also at two stages of the testing operation, in combination with means whereby the rise and descent of the first gas bell, and the control of the apparatus as a whole, are effected automatically by syphonic action. Figs. 5, 6, and 7 show part of the apparatus of figs. 1 and 2 at three successive stages of the testing operation.

In figs. 1 and 2, A and B are expansible chambers constituted by the bells of two gasholders, each of (say) about 500 c.c. capacity; A being, however, slightly larger and heavier than B. The respective bells, which are immersed in liquid seals contained in tanks A^1 and B^1, are connected together in series, whereof A is the first. The tubes which enter the bells through the bottom of the respective tanks and serve alternately as inlets and outlets for the corresponding bells, are for this purpose branched upon a gas supply-pipe C which leads from a small hand pump D supplying the gaseous mixture to be tested and discharges to waste. The gas supply to the respective holders is controlled by three taps on the pipe C, the first tap being between the pump D and the branch leading to the first and larger bell A; the second between the two branches; and the third between the branch leading to the second and smaller bell B, and the waste outlet. The bells A and B are approximately counterbalanced by weights E and F attached to cords passing over pulleys. A vent-pipe G communicating with the interior of the bell A is attached rigidly to the latter—preferably at a point in the crown, and is downwardly bent so as to be adapted to be sealed in an independent vessel containing (say) glycerine, the surface of which stands lower, relatively to the mouth of the pipe G, than does the surface level of the liquid in A^1 relatively to the mouth of the bell A, so that when the bell stands at about its



Simmance and Abady's Gas Analysis Apparatus.

highest level, the mouth of the pipe G may be unsealed. Attached to (or operated by) the bell B is a pointer adapted to work over a scale H divided into 100 equal parts; the zero and highest points of the scale being indicated by the pointer when the bell is near the lowest and highest points of its vertical movement respectively.

Whereas the liquids in A^1 and G^1 should be inert relatively to the gas, or ingredients of the gaseous mixture to be tested, the liquid in B^1 may be a solution of the reagent employed in making the test. A convenient means of ensuring intimate contact between the reagent and the gas entering the bell B is (see figs. 3 and 4) a tube of metal gauze attached at top to the bell B and adapted to work freely over the centre pipe being of approximately the same length as the bell, so that each time the bell rises in consequence of gas entering, a film of the reagent will be carried up by and spread over the gauze tube, through whose meshes the gas as it enters is compelled to pass.

With the apparatus described, the testing operation is performed as follows: The tap separating the bells A and B having been closed, the gaseous mixture to be tested is forced by the pump D into the bell A until the latter rises so far as to lift the vent-pipe G high enough in the vessel G^1 to permit a portion of the gas to bubble through the sealing liquid therein—the bell A, however, always remaining sealed in the tank A^1. While the gas is still bubbling through the sealing liquid in G^1, the tap below A is closed and the pump D stopped, whereupon the bell A sinks by its own weight, driving the vent-pipe G lower in its vessel G^1 until the escape of gas through this pipe ceases, when the bell will remain stationary. Obviously, this condition of equilibrium will be reached, the patentees remark, when the depth of the seal corresponds to the weight of the bell; and inasmuch as this weight is constant, the position of the bell at which equilibrium is attained will also be constant, and the bell will always measure off an equal quantity of gas, whose volume may be determined by adjusting the level of the liquid in the vessel G^1.

The tap below A being thus closed, as is also the outlet tap, the tap separating the bells A and B is opened, with the result that the bell B which is lighter than A, will be charged with gas from A as the latter descends; the reagent in the tank B^1 or washbottle I meanwhile absorbing any constituents of the gaseous mixture upon which it is adapted to act. Thus the volume which enters the bell B will be correspondingly less than that which is expelled from the bell A. The difference will be expressed upon the scale H as a percentage of the volume originally contained in the bell A—the scale having been previously so graduated and adjusted that a rise of the pointer from zero to 100 on the scale will correspond exactly with a full and unaltered volume of gas in the bell A. Hence the indication made by the pointer will always shew, directly, the precise proportion of the gas or gaseous mixture absorbed by the reagent.

Instead of using a force pump to inject gas into the bell A, the latter might itself be made to serve as a suction pump; an arrangement for this purpose being illustrated in figs. 3 and 4 in combination with devices whereby the action of the apparatus is rendered entirely automatic. For the weight E, fig. 1, wherehy the bell A is approximately counterbalanced, is substituted a float J adapted to rise and fall within an open-topped vessel J^1; the weight of the float, when unsupported by liquid in the vessel J^1, being sufficient to raise the bell A so as to cause the latter to inhale a charge of gas. A stream of water is allowed to trickle constantly into the vessel J^1 through a pipe controlled by a tap, while there is a syphon tube connected with the vessel and adapted to rapidly empty it on the water therein rising somewhat higher than is required to raise the float J so far as to allow of the bell A descending to the full extent of its adjusted travel. Two of the taps referred to above are replaced by automatically acting non-return suction and delivery valves as indicated, while the third tap, which is normally held closed by means of a weight K attached to one arm of a lever fast on the spindle of the tap-plug, is adapted to be opened temporarily by the weight K being overcome by that of the water discharged by the syphon tube into a cup K^1 mounted on the other arm of the lever. The cup K^1 has a perforated bottom to allow of the water which is periodically delivered into it escaping after the tap has been opened by the reversal of the lever as indicated in fig. 4.

The action of the apparatus is as follows: On the vessel J^1 being emptied, the float J, ceasing to be supported, will descend, and by so doing will draw up the bell A; the vacuum thus created in the latter being filled by gas drawn into the bell. The rate of flow of water is so adjusted that as soon as the bell A attains the highest point in its travel the float J will commence to rise, and will thereafter continue to ascend until the bell A has descended to the full extent of its adjusted travel. The bell A, by its descent, expels its gaseous contents into the bell B, the exit from which will meanwhile have been closed by the action of the weight K on the tap. The gas as it passes to the bell B will be acted upon by the reagent; and this bell will therefore rise to a height (as indicated by the pointer on the scale H) corresponding to the amount of absorption produced by the action of the reagent. After the bells A and B have completed their downward and upward travels respectively, the water in the vessel J^1 will rise to the summit of the syphon tube; and the syphon coming into operation, the water in J^1 will be rapidly discharged and, by temporarily weighting the cup K^1, will cause the tap to be opened, and so held, long enough to allow of the bell B (which in this arrangement is made heavier than its approximate counterweight F) descending and expelling its gaseous contents to waste. The emptying of the vessel J^1 will meanwhile, as first explained, have permitted the float J to descend; the entire cycle of operations thereupon recommencing and being repeated, as already described, so long as water continues to flow into the vessel J^1.

It is to be observed that though the methods of working described with reference to the arrangements illustrated in figs. 1 to 4 are identical both essentially and as regards the results obtained, they differ with respect to the conditions existing in the bell A during part of the operation. In other words, while in both cases the gas in bell A, before being allowed to pass from A to B, is always brought to the predetermined pressure (usually approximately atmospheric pressure) at which the test is to be actually made, the test pressure is arrived at from (so to speak) opposite sides in the two cases. Thus, in the case of figs. 1 and 2 (where the gas is injected into A under a pressure above that of the atmosphere) the test pressure is reached by reducing the pressure originally existing in the bell A, whereas in the case of figs. 3 and 4 (where the gas is drawn into A at a pressure below that of the atmosphere) the test pressure is arrived at by increasing the pressure originally existing in the bell A.

Now, under the conditions found in the arrangement shown in figs. 1 and 2, it is obvious that the necessary reduction in the pressure of the gas in the bell A is effected by the escape of a portion of the gas through the vent-pipe G on the bell rising above a certain level, as already described. Under the conditions found in the arrangement shown in figs. 3 and 4, however, the necessary increase in the pressure within the bell A results from the fact of the partial vacuum, created hy the rise of the bell, becoming filled by the indraught of gas sucked into the bell. In both cases the pressure obtained within the bell A is determined by the depth of the liquid seal above the mouth of the vent-pipe G; and it is evident that, in order to conduct the test under actual atmospheric pressure, the bell A must be raised until the vent-pipe G is lifted, momentarily, clear of its seal. This cannot result, however, in the entry of air into the bell by way of the pipe G in either case.

In the case of figs. 1 and 2, the higher pressure within the bell will begin to escape through G before this pipe is lifted clear of its seal; and the moment equilibrium between the pressures inside and outside of the bell is attained (*i.e.*, immediately after the supply of gas is cut off), the bell will descend of its own accord and the tube G will become re-sealed. In the case of figs. 3 and 4, the partial vacuum created within the bell A as the latter is lifted may be filled with gas as

quickly as it is formed; but whether this be so or not, the ingress of air by way of the vent-pipe G, during such portion of the rise of the bell as takes place after the exposure of the mouth of the vent-pipe, will be prevented by the closure of the mouth of the pipe by a plug G (Fig. 5) of the liquid (*e g.* glycerine) which constitutes the seal. This plug L, which will be carried up along with the pipe G by atmospheric pressure, will remain in the pipe until the bell begins to descend, whereupon the pressure within the bell will increase to a degree even slightly above that of the atmosphere. It will be evident that during such increase in the internal pressure, no air can enter the bell by the pipe G, the period of equilibrium between the internal and external pressures (during which air might enter by diffusion owing to the liquid plug L then falling from the pipe, as indicated in fig. 6) being of momentary duration.

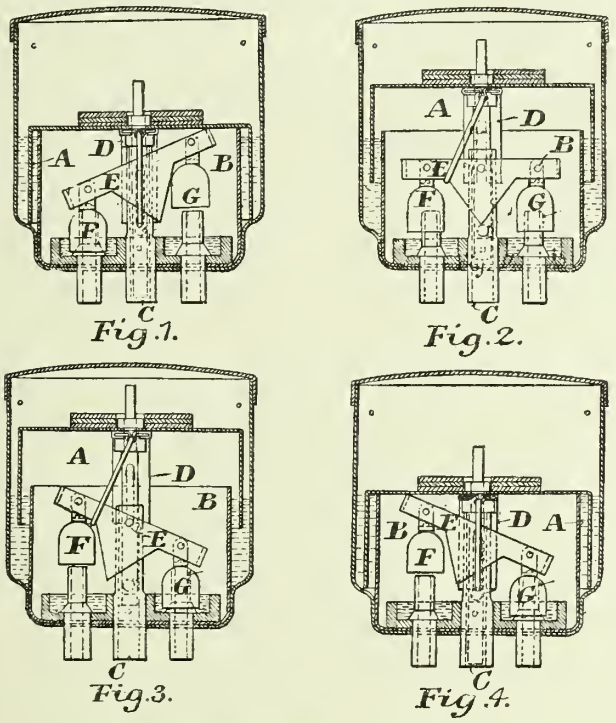
In order to ensure a uniform volume of gas being obtained in the bell A, the stroke of the latter must be of sufficient length to admit of the reversal of the conditions (as regards pressures respectively inside and outside the bell, as just described) taking place before the pipe G has descended so deeply in its seal as to prevent the escape of any surplus gas from within the bell, as indicated in fig. 7.

Lighting and Extinguishing Gas-Lights from a Distance.

Robson, G., of Sydney, New South Wales.
No. 19,225; Aug. 28, 1906.

This is an apparatus for lighting and extinguishing lamps from a distance by suddenly increasing or decreasing the pressure of gas in the mains. Pivoted yokes and mercury seals are used, with the object of providing for this purpose "a small simple and effective device without structural complications, which will be reliable in its action under all conditions obtainable in street gas-lighting practice."

The patentee employs a motor bell A which forms the roof of the gas chamber B. This bell is adapted to rise and fall on a vertical guide rod moved within a fixed tubular standard C secured to the bottom of the chamber. A bracket D (secured to the guide rod) carries a hanging link which alternately passes to the right and left of a spear point on a beam E each time the motor bell rises. Weights regulate the weight of the motor bell and determine the pressure at which the bell will rise.



Robson's Lamp Lighter and Extinguisher.

Fig. 1 shows the motor bell in its lowest position—that is to say, with the gas pressure in the main reduced to or below the engaging pressure. The gas passages to the main burner are closed by the small bell F which is immersed in its mercury seal while the bell G is raised clear—thus leaving the passages G to the pilot-burner open. Fig. 2 shows the motor bell partly raised and the oscillating beam E level; the small bells F G being unsealed, with the gas passing to both burners. Fig. 3 shows the motor bell fully raised to its highest position; the gas passage to the pilot-burner being closed by the small bell G which is immersed in its mercury seal while the bell F is raised clear—thus leaving the gas passage to the main burner open. Fig. 4 shows the motor bell again in its lowest position engaged or ready at its next rise to reverse the last preceding operation. This alternate opening and shutting of the gas outlets continues so long as the gas pressure is first reduced to the engaging pressure and then raised to such a pressure as will raise the motor bell to its highest position.

The method of operating the apparatus is as follows: The mercury seals are filled, and sufficient weight is placed on the motor bell to correspond with the predetermined pressure at which the device is to be operated. One of the burners is then lighted; and when it is desired to extinguish this burner and light the other the pressure in the main is reduced, which causes the motor bell to fall into the position shown in figs. 1 and 4, while the beam and small bells retain their positions. The pressure is then increased, with the result that the bell rises and reverses the position of the beam and small bells—thus extinguishing one burner and lighting the other.

Withdrawing Low-Grade Gases during the Charging and Discharging of Retorts and the Like.

Koppers, H., of Essen-Ruhr, Germany.
No. 21,269; Sept. 25, 1906. Date claimed under International Convention, Oct. 23, 1905.

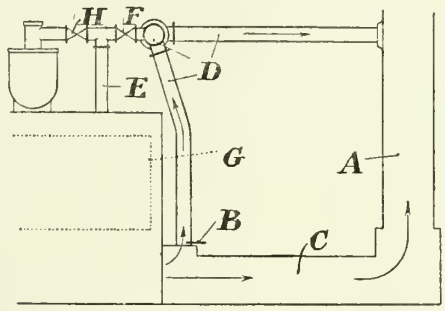
The suggested utilization of the gases and vapours evolved during the discharging and charging of coke-ovens when the main gas conduit is disconnected in a furnace or condensation plant would appear, the patentee remarks, to be of little value industrially in most cases, owing to their low value. If it is desired to avoid inconveniencing the workmen by the free escape of such gases from the ascension pipes, by conducting them through a separate, temporarily connected conduit into the chimney, the risk of explosion has to be reckoned with, as this arises in view of the fact that the gas does not flow continuously, but is liable to collect and become dammed up in the conduits.

In accordance with the principle of this invention, gases of this kind, which are produced in dry distillation or gasification during the discharging and charging of the chambers or retorts, are conducted (as being of too little value for further utilization) through a separate conduit into a chimney; but the danger of explosion is obviated owing to the fact that the conduit is constantly traversed by a current of neutral gases.

As such neutral or inert gases, the combustion gases of the furnace will, he continues, of course suggest themselves in the first instance. By deflecting a portion of the combustion gases shortly before their admission to the chimney and transferring them into the conduit for the low-grade gases, which likewise leads into the chimney, a parallelly arranged, subsidiary path is provided for the combustion gases. By inserting and removing a suitable resistance in this conduit—that is to say, by an appropriate adjustment of dampers—the quantity of combustion gases flowing through may be regulated.

The continuous current through the conduit, the prevention of the access of air by constantly filling all available space in the conduit with neutral gases and the larger dilution of the gases, which were already low-grade, render explosion almost impossible.

The following is an example of means for carrying the process into practice: A conduit connected, on the one hand, with the chimney and, on the other hand, fitted to the combustion gas conduit with the interposition of a damper, is carried along the ascension pipes of the retorts with which it is connected by branches. Every time an ascension pipe (and thereby a retort) is disconnected from the main gas-collecting conduit, the corresponding branch is connected with the low-grade gas conduit, so that the gases and vapours then present in the disconnected retort are conducted into the chimney.



Koppers' Arrangement of Coke Oven or Retort.

The method illustrated of carrying the process into practice consists of a conduit D connected, on the one hand, with the chimney A and, on the other hand, fitted to the combustion gas conduit C with the interposition of a damper B, is carried along the ascension pipes E with which it is connected by branches F. Every time an ascension pipe is disconnected, the corresponding branch F is connected with the conduit D, so that the gases and vapours then present in the distillation chambers G are conducted into the chimney. It is advantageous to connect the valve H of the ascension pipe and that for the branches F so that on opening the former the latter is closed and *vice versâ*. The reversal during the stages of the operation which have been referred to then takes place "without inconvenience or danger to the workmen."

Gas-Meters.

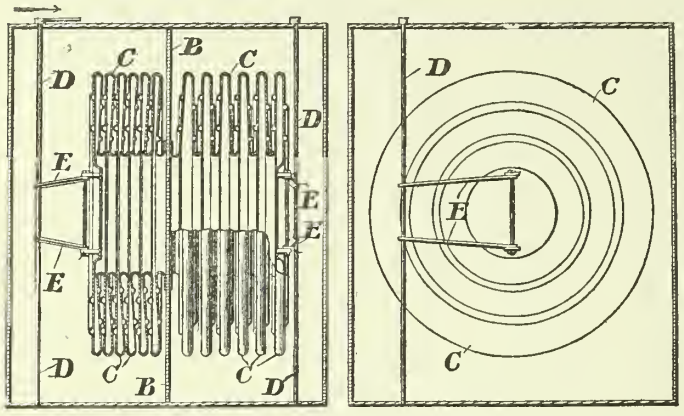
Weir, A. S. J., and Henning, T. J., of San Diego, California.
No. 22,405; Oct. 10, 1906.

This invention relates to "diaphragm gas-meters, in which the casing or body of the meter is divided by a central vertical partition into equal compartments or chambers, each containing a bellows or expansible diaphragm adapted to alternately receive and discharge a certain volume of gas and connected with valves controlling the alternate inlet and outlet of gas and also connected with a register."

The casing of the meter is rectangular, as usual with diaphragm meters. B is the vertical partition dividing the casing into two equal compartments. In each compartment is arranged an expansible bellows C provided with means by which the valves governing the inlet and outlet of gas from the respective compartments are operated, and also a registering apparatus (neither shown). Such means comprises a flag wire or rod D journaled in the meter-casing and provided at its upper end with a lever or crank arm connected with the valve and registering mechanism. The rod is connected with the bellows by arms or levers E, fast on the rod and pivoted upon a cross rod F arranged in lugs forming an attachment of the head of the bellows.

As shown, each bellows, secured to the partition B, is made of sheet steel and the details of construction are as follows: The head of the bellows is formed entire or integral, and its circular edge is turned inward as shown. All the remaining portion of each bellows is formed

of a series of annular sections, the outer and inner edges of which are turned inward but in opposite directions, so that they are adapted to overlap and fit upon the edges of adjacent sections. Such lapping portions are made gas-tight; and thus when the head and the required number of sections are secured together, a metallic bellows or diaphragm is formed, which has the "required degree of flexibility which allows it to expand under pressure of gas, and contract when relieved of such pressure."



Weir and Henning's Dry Gas-Meters.

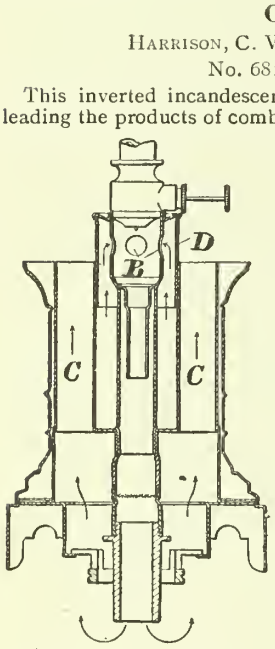
It is requisite, the patentees remark, that the bellows thus formed of flexible sheet metal shall have a certain degree of resiliency and at the same time the body of the several sections must have a certain degree of rigidity. This is obtained in part by circular corrugations (preferably two in each section) formed by striking up the sections in such manner that semi-circular grooves are formed on the inner sides and corresponding projections on the outer sides. Thus two circular concentric ribs or corrugations are formed on the outer side of each section. Further, the ribs or corrugations are so arranged that they are "staggered"—that is to say, the ribs of adjacent sections are not arranged directly opposite each other, but at different distances from the edges of the sections. Thus when the bellows collapses, as shown in the left-hand portion, the adjacent corrugations will not strike upon each other, but upon the body or plain surface of the opposite section. The convolutions of the bellows are in this way adapted to fit closer together when relieved of the pressure of gas than would be otherwise practicable.

Gas-Lamp.

HARRISON, C. W., of Middlesex Street, E.C.

No. 6819; March 21, 1907.

This inverted incandescent gas-lamp has conduits or uptakes for leading the products of combustion to the exterior of the lamp, terminating at a point below or adjacent to the air inlet apertures of the bunsen tube, and a hood or shield so arranged that the air induced into the bunsen tube is drawn from below the level of the outlet for the products of combustion, and thus prevents the latter from mixing with the induced air.



Harrison's Gas-Lamp.

As shown, the products of combustion of the bunsen tube ascend through uptakes C, which terminate below the inlet apertures B and "do not therefore present an unsightly appearance." D is the hood or shield mounted so as to prevent the products of combustion ascending the uptakes C from being drawn into the inlet apertures. The external air induced through these apertures passes through perforations in the body portion of the lamp to the spaces between the uptakes C and thence through the open end of D, which may be made capable of movement on the bunsen tube to enable the air inlet apertures to be adjusted when desired. The lower ends of the uptakes may be provided with a depending flange adapted to support the mantle holder in place on the lamp.

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19,706.—WAKEFIELD, C. C., "Acetylene generators." Sept. 3.

19,768.—EVANS-JACKSON, J. E., "Photometer." A communication from Haakon Bryhni, &c. Sept. 4.

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19,799.—DAVIS, A., "Generators for acetylene." Sept. 4.

19,804.—BEST, W. N., J. H., and E., "Gas-stoves." Sept. 4.

19,811.—HARRISON, C. W. and NOAD, A. C., "Incandescent gas-lamps." Sept. 4.

19,873.—RIDER, C. H., "Extracting and manufacturing fuel gas from a mixture of mineral carbonates and organic substances." Sept. 5.

19,933.—DAVEY, W. G. S., "Mantles," Sept. 6.

19,963.—ANDERSON, D., "Inverted lamps." Sept. 6.

19,988.—GROSSMAN, J., "Treatment of ammonia liquors before and after distillation." Sept. 7.

20,009.—DELSAUX, S., "Valve-gear for gas lighting." Sept. 7.

LEGAL INTELLIGENCE.

VALUATION APPEALS IN SCOTLAND.

There has been quite a crop of appeals against valuations of gas-works in the South of Scotland, the hearings of which have been taken before the Valuation Courts. These have arisen through the action of Mr. Sulley, who is largely employed by local authorities in the South of Scotland as Assessor, in raising the valuations.

In the Selkirk Burgh Court last Tuesday, there was no appeal; but the Assessor reported that, following the decision in the Kirkcaldy Gas Company's case in the Court of Session, he had assessed the gas undertaking within the burgh on the basis of profits, as therein laid down. Last year the gas-works, which had always included the pipes, were valued at £385. When he first made his valuation this year, he assessed the whole undertaking at £1018; but for the convenience of the rating authorities, who assessed the pipes underground on a different basis from the rest of the undertaking, he entered them separately—assessing the pipes at £150 and the works at £868. These figures were calculated at a time when the Secretary of the Company was from home. A day or two after the Secretary returned, he saw him; and having ascertained that the profit from the undertaking situated in the county amounted roundly to £120, he adjusted £900 as the total valuation. On going into the profits earned by the Company during the last twenty years, he found that for rating purposes, and on the basis of the Kirkcaldy case, they averaged as nearly as might be, £385 per annum, which was his former valuation.

The Selkirkshire (County) Valuation Court was held the next day, and in it an appeal was taken by the Gas Company against the valuation of the pipes outside the burgh. It was said, on behalf of the Company, that the Assessor had raised the valuation from £15 to £400; that in the burgh the valuation had been fixed at £993; and that the Company were prepared to accept £90, being one-eleventh of the whole valuation. Last year the make of gas was 34 million cubic feet, and of this, over 3 million cubic feet was taken by consumers in the county. It might seem strange that the pipes had been entered at £15; but they had been entered on a wrong principle. Mr. Sulley had drawn attention to the principle; and they had accepted his figures. Mr. Sulley said he found that there had been a great under-valuation, and that the county had suffered consequently in loss of rates. He submitted that when he brought before them the fact that they had been deprived for many years of a large amount in loss of rates, the sum of £400 was quite equitable. The circumstances were exceptional. In the first place, the Gas Company admitted the fact of under-valuation, and were now making an offer to the county. The sum of £15 was fixed by Mr. Sulley's predecessor. Evidence was led; and the Court having deliberated in private, the Chairman—Mr. C. H. Scott-Plummer—stated that, in their opinion, they were not justified in fixing a larger sum on the enterprise because in previous years they had had a small valuation. They must fix a valuation which might be considered as near as possible to be the valuation from year to year. They therefore decided to fix the valuation of the county section at £95, which was something like one-eleventh of the total value.

In the Roxburgh County Valuation Court last Tuesday, the Melrose Gas Company appealed against the valuation of their works being raised to £456, and asked that it be reduced to £248. Mr. Sulley said that on the usual basis the valuation should be £248; but he found that there had been an exceptional decrease in the profits. He therefore proposed to adopt the basis of an average, as was done in Fife and some other counties. The figures for the past five years brought out £456. The practice was one which was adopted throughout a large part of Scotland. On behalf of the Company, it was maintained that in no case had Mr. Sulley's contention been upheld by the Courts. The result of a definite calculation on the year as it stood had always been upheld by the Courts, and should be adopted in this instance. A member of the Court said that this method of taking an average seemed to have been sprung on the Melrose Gas Company, whose works had previously been always valued year by year. The Court dismissed the Company's appeal; but, on the request of their Solicitor, they agreed to state a case for the Court of Session.

A decision by the Valuation Court for the City of Dundee seems to fix an awkward principle for the valuation of suction gas-engines. Messrs. E. & G. Gibb, manufacturers, appealed against the value of their engine being entered at £100. The engine, the appellants stated, cost £1200. It was rated at 45 H.P. nominal, but was capable of working up to 200 H.P. At the present time, it was only working at 60 H.P. There were only 900 spindles in the place; but the engine could drive 3000. It was claimed that the engine should be taxed on what work it was performing. The rent of the property was £140, and with the engine at £100 it would be £240. Only a small amount of machinery had been put in. If the engine were fully employed, there would be no complaint against the valuation. They considered that £240 a year on 900 spindles was too high, and suggested that the valuation of the engine just now should be £30. With Welsh coal the engine might work up to 200 H.P., but with Scotch coal it could not go beyond 150 H.P. Mr. G. C. Brown, the Assessor, said the cost of the engine and shed it was situated in was £1250. The rule was to charge 7½ per cent. on outlay of this kind for valuation purposes; but he was not satisfied that, in dealing with machinery, this was sufficient. Machinery depreciated much more quickly than buildings; and if a proprietor were to let a machine, he would require more than 7½ per cent. of the cost for rent. Depreciation could hardly be taken at less than 5 per cent., and that would leave him with only 2½ per cent. as interest on the capital in the plant. It had been argued that with 60 H.P. the rate was equal to £1 13s. per horse power; but in a case from Arbroath in the Court of Session it had been brought out that in ten cases the rate per horse power varied from 15s. to 40s., according to the nature of the engine. According to Act of Parliament, an engine was a heritable subject; and the rule was to assess it as a whole, whether it were fully occupied or not. Mr. Councillor Speed asked if

Mr. Brown knew a case where an engine was treated in this way. Mr. Brown replied that he did not; but it would be impossible for an assessor to know up to what extent every engine in the city was working. One of the appellants said he was convinced that the valuation was excessive and unjust, and that he could not work under such conditions. Mr. Brown replied that his valuation was only at the rate of 10s. per horse power, whereas in Arbroath from 15s. to 40s. had been allowed on steam-engines. The Court fixed the valuation at £90; and an appeal was intimated by Messrs. Gibb.

Bankruptcy of a Lighting Specialist.

The public examination of Reginald Arthur Williams, trading as the Universal Lighting Company, of Victoria Street, S.W., was held at the London Bankruptcy Court on Tuesday last before Registrar Giffard. The statement of affairs filed by the debtor disclosed gross liabilities amounting to £751 7s. 10d., of which £741 7s. 10d. was expected to rank against the estate for dividend. The assets were estimated to produce £112 4s., thus leaving a deficiency of £629 3s. 10d. Replying to questions put by the Official Receiver, debtor stated that prior to 1903 he was engaged in various occupations in this country and South Africa. He then with a capital of about £50 commenced business as an oil merchant at Cardiff Exchange. The business was unsuccessful, however, and he closed it. He then obtained employment as canvasser for a Cable Company, earning £5 per week. In December, 1906, he was joined in partnership by another (who put £500 into the business), and they traded as Buss and Williams, lighting contractors, at No. 25, Victoria Street, S W. The partnership was dissolved about five months afterwards, and debtor agreed to take over the assets £235, and liabilities £83, and repay the £500 advanced by his partner, less £90 which the latter had drawn out of the business. He (Williams) then continued the business under the style of the Universal Lighting Company; but he was always handicapped by want of capital, and a committal order having been made against him these proceedings ensued. Debtor alleged his failure to have been caused through want of capital. He had no household furniture, and resided in furnished apartments. The principal part of his business consisting of tendering for lighting contracts at large houses. He knew nothing about the business before he joined Mr. Buss; but he was well acquainted with the gas-mantle trade. He admitted that he changed a cheque for 30s. with a chemist to whom he owed 1s. 3d. The chemist handed him the balance 28s. 9d.; but the cheque was not met. He justified this action by the fact that he was expecting a cheque which he would have paid into his banking account to meet the 30s. cheque. The examination was closed.

Water for Cooling Beer.

At the Ashton Borough Police Court recently, Alfred Buckley, Licensee of the Clarence Inn, Old Cross Street, was summoned at the instance of the Joint Water-Works Committee with misusing water on July 25. The Town Clerk (Mr. F. W. Bromley), who prosecuted, said that on the night of July 24 it was found there was an excessive use of water on the defendant's premises. In consequence, Mr. J. A. Wild, the Manager of the Water-Works Department, went to the defendant's house the following day, and saw his wife, and told her he and the waterman had come down to test the fittings. In the cellar they found that an india-rubber hose had been attached to a tap, and water was running on the floor of the cellar under the beer barrels into a drain on the other side. Mr. Wild asked for an explanation, and defendant's wife said it was to keep the beer cool. It was difficult to discover cases of this kind, inasmuch as they could not be continually going into public-houses to see what was being done to cool the beer. The tap was probably turned on night and day; and very serious waste of water must have taken place. The defendant said he had been swilling the cellar the night before, and forgot to turn the water off. The water was not running to cool the beer. He denied the statement said to have been made by his wife. Mr. Wild deposed that the water was running at the rate of about 100 gallons per hour. The defendant said that every time there was heavy rain, the cellar floor got covered with sludge, through water coming up the drain. He acknowledged that the tap was running all night, but urged that it was a mistake. The Chairman said the defendant would be fined 40s. and costs; and the advocate's fee would be allowed. He added that the defendant had been robbing the Joint Water-Works Board.

Reign of Darkness at Corbridge.—In consequence, it is reported, of the Corbridge Gas Company and the Parish Council being unable to agree as to the terms for lighting the village and approaches during the ensuing winter, the lamps have not yet been lit; and as the former show no signs of relenting, the Sub-Committee of the Parish Council were, at their last meeting, empowered to make such other arrangements as might be deemed necessary in regard to the matter. In the meantime, the streets will remain in darkness at night time.

The Reinstatement of Streets after Main-Laying Operations.—The Works Committee of the Deptford Borough Council on Monday last week reported having considered a letter from the Clerk to the Metropolitan Water Board, stating that that authority had entered into agreements with various local governing bodies under which those bodies undertook the duty of reinstating at an agreed schedule of prices, the surface of roads and footways broken up for the purposes of the Metropolitan Water Board's work, and inquiring whether the Deptford Council desired to enter into such an arrangement. The Committee had inquired into the matter, and had found that it was not the practice for the Deptford Council to enter into any agreement with companies having statutory powers to break open roads, to reinstate same after being opened up; and the Committee had come to the conclusion that it was preferable that the duty and responsibility connected with the reinstatements should remain with the companies—the work, of course, having to be executed to the satisfaction of the Council's officers.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY AND METER-RENTS.

In accordance with the decision arrived at to re-impose meter-rents, instead of raising the price of gas to meet the increased cost of coal, the Gaslight and Coke Company last week sent out notices intimating that, as from Michaelmas next, quarterly rents will be charged on the Company's ordinary meters. The rent of a 5-light meter will be 9d. per quarter; and the charge will, of course, be varied according to size. The circular is in the following terms:—

The Directors have to announce that the Company's contracts for the supply of coal and oil for the next twelve months have been made at prices seriously higher than those of last year, involving an increased expenditure of some £250,000; and that, though the Company will in all probability receive better prices for coke, the increased revenue from this source will not be sufficient to meet the increased price of raw materials. As an alternative to raising the price of gas by 1d. per 1000 cubic feet, the Directors have decided, with the concurrence of the London County Council, to re-introduce meter-rents, which are estimated to yield a revenue amounting to about ¾d. per 1000 cubic feet of gas sold. Meter-rents are charged by the other Metropolitan Gas Companies, the Suburban Gas Companies, and also by electric lighting companies. The Directors of the Company feel that the charge is a perfectly fair one; and, moreover, they are anxious to put an end to the absurdity of having to provide large and expensive meters, free of cost, for a certain section of the public who only consume gas as a stand-by at times when other systems of lighting fail them.

It should be added that, though the London County Council were agreeable to meter-rents being charged as from Midsummer last, the Company have decided that the charge will not commence until Michaelmas next. The Directors are most anxious to reduce the price of gas at the earliest possible moment; and it is to be hoped that the price of coal will not be long maintained at its present high figure. As soon as the price of coal allows, the Company will give their consumers the benefit of the reduction in the price of gas.

BRADFORD'S MUNICIPAL UNDERTAKINGS.

The Question of Profits.

At a Meeting of the Bradford City Council last Tuesday, Alderman David Wade made his annual statement with regard to the trading departments of the Corporation.

He said that the outstanding feature of last year's report upon the trading concerns, having regard to the large capital invested, was probably the small aggregate net profit—namely, £365. Last year he ventured figuratively to describe that result as "sailing very near the wind;" and he had had no reason to alter his opinion. With an invested capital of £6,500,000, £365 net profit left no margin for possible contingencies, which were the common heritage of them all. They were inherent in the natural order of things; and Bradford as a Municipality could not expect, more than other towns, exceptional freedom therefrom. Unforeseen disasters in gas-works, electricity works, water-works, and tramways—in which last-named department there had recently been experienced an unfortunate illustration—all pointed to the great importance of taking into serious consideration the question of improving the small margin which these several undertakings provided to meet such contingencies. The necessity of forming a small Executive Committee to deal, among other subjects, with questions of this character was a step which he thought the Council should take. The Council would be glad to know that, as a whole, they could show an improvement upon the £365 of the previous year. The aggregated surpluses and deficits showed a net surplus of £10,610. It should be mentioned, however, that this result had been achieved mainly through the water-works equation scheme, which provided for a consolidated and accumulating sinking fund for redemption of its debt, and which, having regard to the terms under which the scheme was drawn, had relieved the expenditure to the extent of £10,525. It would be seen, therefore, that, apart from the relief afforded by the scheme, the net aggregated surplus for the past year would have been £85, as compared with the £365 during the previous year. The surpluses and deficits for the year were as follows: Surpluses: Water-works, £3016; gas, £3486; electricity, £4451; markets, £1877; workshops, £70—total, £12,900. Deficits: Conditioning house, £276; team labour, £1819; slab-making, £81; milk depôt, £114—total, £2290. Apart from the relief afforded by the equation, the water-works would have shown a deficit of £7509, instead of a surplus of £3016. The balance of income over expenditure in the tramways account (£14,536) had been transferred to the renewals fund, as in previous years. Turning to the figures of the several trading concerns separately, and commencing with the water-works, Alderman Wade said the gross income of this department was £179,547, and the working expenses £35,630, leaving a gross profit of £143,917. Interest and sinking fund absorbed £140,901, leaving a net profit of £3016, as compared with a net loss the year previous of £9117. The deficit of the water-works at the beginning of the year was £28,496; and the net profit of £3016 reduced the deficit to £25,480. This deficit would doubtless be further substantially reduced during the present financial year through the operation of the equation scheme. The total income from the gas-works, including residual products and rental of meters, was £286,800. The working expenses for the year were £221,344, leaving a gross profit of £65,456. Against this there was charged for interest and sinking fund £61,970, leaving a net profit of £3486, as compared with a net profit of £6022 the previous year. The unappropriated profit at the beginning of the year was £5438. Of this sum, £5000 was ear-marked to the relief of the rates, leaving £438; and this, with a net

profit of £3486, made an unappropriated profit at the end of the year of £3924, or less than at the beginning of the year by £1514.

Having dealt similarly with all the other departments, he said he would ask the Council whether, in the event of an unexpected turn in the wheel of circumstances, it would not be found that, as advocates of the principle of cost price, their ambition had not over-reached itself, and led them to miss the meaning of cost price in its strictest commercial sense. To make ends meet as compared with the realizing of large profits from dear commodities, in order to secure a less poundage rate, of course, raised a plain and straightforward issue. It was simply a revival of the old question of direct *versus* indirect taxation, into the merits of which he did not wish to enter at any length. But he could not refrain from repeating what he had aforetime stated—that commodities sold to themselves at cost price (which price must include all charges incidental to the undertaking) were just as essentially profits from a practical point of view as if twice the charge was imposed, and the surplus applied to the relief of the poundage rate, because in the case of the lower charge the difference was profit retained in the ratepayers' pocket, instead of being taken out and appropriated under the name of profit towards the reduction of charges under another heading of account. Cost price in a co-operative body was profit in disguise—profit in another dress. If the Council chose, for the sake of appearance, to raise the price of gas, for instance, to the average price of the majority of the principal towns, they would secure, with the same consumption, between £40,000 and £50,000 so called profit, which would have the effect of reducing the rates by (say) 8d. in the pound; but it would be taking it out of one pocket and putting it into another. He put this before the Council as a proposition—that on general lines ratepayers, who were legally the owners of all the public services within their area, could never make a profit out of themselves. It was only a question of what head of account they should pay under. If they paid more than was required for commodities, the surplus went back to them in relief of rates under the head of non-trading departments. As a conglomerate body, ratepayers were neither better nor worse in pocket under either system, except that with huge trading profits they must sacrifice, for the sake of appearing to have made such profits, the income-tax of 1s. in the pound to the Inland Revenue—just for the passing glory of a paper surplus. They must pay 1s. in the pound on such surpluses to the national exchequer; while every such shilling rightly belonged to the ratepayers within the limits of the Bradford area. The relative size of the poundage rate as between municipal authorities was too readily accepted as the test of good government and administration. If the rate was low, the government was good; and *vice versâ*. The man in the street and the stranger who came to Bradford to make his abode asked as a primary question—the answer to which he regarded as a conclusive proof of the efficiency or otherwise of local government—What are the rates in the pound? Upon the poundage rate alone he often determined and assessed in his own mind the stability of the town and the comfort and security of citizenship. Such a test might be popular; but taken by itself it was as poor as it was popular. If ratepayers wished to institute a comparison of the burdens of local taxation as between one town and another, they must put all charges into the melting-pot. If the State were to nationalize all the public services and create a common fund into which all temporary surpluses were paid, and to which all temporary deficits were charged, and if such a fund were made to hold the balance against fluctuating Army and Navy votes, &c., they would have arrived at, or at least be travelling in the direction of, an ideal state of taxation. And what was good when applied to the nation, was good when applied to local administration. A steady poundage rate, if it could be secured, was better, and revealed a sounder administration, than a fluctuating one brought about by the caprice of Party or from any other cause. Upon the recent estimates of the various Committees, combined with the watchful expenditure of the last year, the Council were able to reduce the rates by 2d. in the pound for the current year. He should have been glad to recommend a further reduction; but the logic of facts was against it. There was a certain amount of leeway to make up before they began relieving rates; and they must be just before they were generous. Though there was a small surplus in the gas and electricity departments, there was a considerably larger deficit to overtake in the water-works department, and towards which the Council refused to levy a rate; and to relieve rates by small surpluses and leave larger deficits to take care of themselves, was bad finance. A company whose dividends were one year upon the mountain top and in the next down in the valley, would not invite public confidence or be likely to attract shareholders. The trading concerns of the Corporation were of no mean or trifling dimensions. In proportion to population and rateable value, they ranked prominently among the municipalities of Great Britain. Talk about combines—they were the largest combine in Bradford. They had expended over £11,000,000; and they employed over 8000 people. The proper guidance of this gigantic undertaking called for the exercise of their keenest powers and their best judgment. If the private trader could succeed, then so could the Corporation, who ran precisely similar concerns. He would never believe that they could not bring the same amount of intelligence to bear in the committee-rooms of the Corporation as was to be found in the board-rooms of private companies. But they must remember that among a body of directors Party played no part when dividends were the aim; and if they buried the factitious spirit in one common endeavour to secure the interest of all, they would achieve that solid success which always waited upon singleness of aim and unity of purpose, and for which—rightly understood—their charters of incorporation had doubtless been granted.

At the conclusion of the speech, there was some criticism of Alderman Wade's views. Several members professed to perceive a strong vein of humour in what had been said; while others twitted the Alderman with inconsistency. One member argued that the speech was in direct opposition to principles advocated last year. He instanced the taking of £5000 from the gas profits in relief of the rates; while now the principle of allocating profits in this way was apparently regarded by Alderman Wade as unsound. Eventually, however, the minutes of the Finance and General Purposes Committee were adopted.

RIVAL GAS SUPPLIES AT DRAYCOTT.

Intended Application to Parliament.

Mr. E. Jardine, J.P., the Chairman of the Draycott Gas Company, in an interview a few days ago with a representative of the "Nottingham Daily Express," stated that his Company intended to apply for an Act of Parliament prohibiting the Long Eaton Gas Company from entering the Draycott district. "We intend," he said, "to fight them. I believe the people of the district are really in sympathy with us, and that there is a growing feeling of antagonism in Long Eaton itself against the action of the Company in supplying the stranger out Draycott way with gas at 2s. per 1000 cubic feet, while the old consumers in Long Eaton have to pay 3s. I should not be surprised at their resentment going so far as 'passive resistance.'" After adding that the Draycott Company did not object to fair open competition, Mr. Jardine said: "What we do object to is our opponents exploiting the Long Eaton consumer for the purpose of crushing a successful little Company. We are prepared to fight them on equal terms; and if they would supply Long Eaton at the same price as they are supplying Draycott, we should not mind."

The Draycott Company, Mr. Jardine explained, have no powers at present excluding other companies from coming into their district, but the Long Eaton Company have powers which prevent any other company competing with them in the Long Eaton district. The next move, therefore, is for the Draycott Company to apply for an Act of Parliament; and he expressed great confidence in their ultimate success in this direction.

OTTOMAN GAS COMPANY, LIMITED.

Steady Progress Reported.

The Ordinary General Meeting of the Company was held on Tuesday last, at the London Offices, No. 9, Queen Street Place, E.C.—Colonel James Le Geyt Daniell in the chair.

The Secretary (Mr. Thomas Guyatt) read the notice convening the meeting, the certificate of the Auditors, and the minutes of the previous meeting; and the report and accounts were taken as read. The report stated that the gas-rental for the half year to June 30 amounted to £14,802, compared with £13,261 for the corresponding period of 1906; while the net profit was £3187, against £2991. The amount standing at the credit of profit and loss account was £9422.

The Chairman, in moving the adoption of the report and accounts, remarked that it was with some difficulty that he could find language in which to address the shareholders, without fear of repetition, year after year. Considering first the debit side of the balance-sheet, it would be seen that there was an item "Sundry creditors, £2384," against £1946 in the same period of the previous year. The amortizement account, of course, increased year after year. Turning to the credit side, there was "Sundry debtors, £12,973." There was very little explanation to give in regard to this. The amount was something like £1900 more than in 1906; but all these things varied from time to time. Investments had not increased on the present occasion; but with reference to this matter, he might mention that in the present half year £2000 had been invested, and would appear in the current half-year's accounts. Coming to the revenue account, he had to report with regard to business a steady improvement all round. With the greater quantity of coal carbonized—it was not very much more, only some 150 tons—an increase in the cost might have been looked for; but actually the expenditure under this head was £496 less. That was owing to a fortunate arrangement made on this side, and also to the supply of local coal, which was referred to at the last meeting. Therefore they were in a very comfortable position. Depreciation renewals and repairs showed an increase of some £1500, it was accounted for by the additional outlay for which the shareholders had already been prepared. Salaries were higher, owing to the arrangement they were most fortunate in making by which Mr. A. F. Phillips had been appointed Consulting Engineer. On this appointment the Company were to be congratulated; and he was sure any expense on this head would bear fruit abundantly. Mr. Phillips was in communication constantly, not only at Smyrna, but at home, with Mr. Gandon, since he had been here. There was a perfect understanding between them; and he did not think there had ever been the slightest difference of opinion on the various points that had to be discussed. The Company must not only keep pace with developments, but must prepare for them; and they owed much to the activity and unstinted service of their staff, who had spared no pains in looking after everything. There had been a thorough examination of the mains throughout; and the staff had met with cheerfulness every demand made upon them. It gave him the greatest pleasure to mention this fact in the presence of their friend Mr. Gandon. It would be a satisfaction to the shareholders to know that everything—whether in the works or in connection with the distribution—was in first-rate order; and that the Company generally, as well as the works, could not, in the opinion of the Board, be in a sounder position. So much for the past and present. With regard to the future, no one knew what it might bring forth; but he for one, in consequence of the arrangements that had been made, had no fear at all. They had through Mr. Gandon to constantly negotiate with the authorities in Smyrna; and all he (the Chairman) could do was to express the hope that moderation and wisdom might attend their counsels, and that in altering existing, or making fresh, arrangements with the Company, such terms would be suggested as it would be possible for the Company to accede to.

Mr. Stephenson R. Clarke seconded the motion, which was at once agreed to.

On the proposition of the Chairman, seconded by Mr. H. Ward Andrews, a dividend was declared for the half year ended June 30 at the rate of 7 per cent. per annum on the preference shares, less income-tax, and at the rate of 7 per cent. per annum on the ordinary shares, tax free,

The CHAIRMAN remarked that he had made passing reference to the services of the Engineer, Secretary, and staff generally; and he would now like to propose a very hearty vote of thanks to them.

Mr. A. M. PADDON, in seconding, said that, of course, the Executive of the Company were led by three personalities—Mr. Phillips, Mr. Gandon, and Mr. Guyatt. With regard to Mr. Phillips, it might justly be remarked that his was a name to conjure with in gas matters. His business had taken him not only to all parts of this country, but to all parts of Europe, and even farther afield; and with reference to any undertaking with which he had been connected, he (Mr. Paddon) had known nothing but success. To the Ottoman Company he was of the greatest value, on account of his particular knowledge of the gas industry of the South of Europe, and everything appertaining thereto. As to Mr. Gandon, they were all very glad to see him here to-day, because the votes of thanks that had been passed to him at previous meetings had always been couched in such terms that he was sure he would be pleased to be present to hear them. With the co-operation of Mr. Phillips with Mr Gandon, he thought they might say that their engineering branch was co-ordinated in the best possible manner. As to Mr. Guyatt, he did not know what they would do without him. The Directors received from him that support which could only be derived from his long connection with the Company and his zealous services.

Mr. GANDON, in returning thanks, said he was pleased to say that the general prosperity of Smyrna went on increasing steadily. Cultivation in the interior was increasing very rapidly, and under very much better circumstances than hitherto. People were beginning to put more money into their land, and to understand that cultivation could not be carried on in the haphazard way that it had been in the past. At the same time, local industries were beginning to take root; and, of course, all this affected their Company in a very favourable manner. What would happen in the future, he could not say; but the prospects were most excellent. They had been obliged of late years to meet considerable increases in demand on the part of their consumers; and he was sure the shareholders must feel very well satisfied that this had been done without adding to the capital account to any appreciable extent. The Smyrna staff were most loyal in advancing the Company's interests, and did everything possible to aid the prosperity of the undertaking.

Mr. GUYATT also acknowledged the vote.

Mr. W. A. HOUNSOM proposed a vote of thanks to the Chairman and Directors; remarking that there were two points which he thought were more eloquent than any words he could say. The first was the extremely small attendance of shareholders at the meetings; and the second the small amount of the transfer fees—7s. 6d.

Mr. A. W. OKE, in seconding, said it was a satisfaction to feel that the prospects of the Company were so good. He was glad to hear the Board were seeking to obtain a portion of their coal from local sources; and he hoped that one of the results of the present rise in price would be to bring further new supplies into the market. Also that it would make people more economical, and induce them to employ to a larger extent the most excellent gas-stoves which were now, if carefully used, a source of considerable saving.

The CHAIRMAN acknowledged the vote.

ILFORD GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held at the Offices, Broadway, Ilford, on Monday last week.

The CHAIRMAN (Mr. W. Ashmole) in moving the adoption of the report and accounts, congratulated the shareholders heartily upon the excellent half-year's working, and expressed the hope that the soundness and vitality shown by the undertaking would be long continued. He thought it needed considerable courage on the part of the Board at the beginning of the year, in face of a rising and already inflated coal market, to make so substantial a concession to consumers as a reduction in price of 3d. per 1000 cubic feet; and it was particularly gratifying that the accounts now presented not only justified, but conclusively proved the wisdom of the policy adopted. The reduction resulted in an immediate increase in the number of consumers and the sales of gas. The increase of consumers and the reduction in price, therefore, acted and re-acted upon each other; and it was obvious that not only was it to the Company's interest to encourage the use of gas but to the direct advantage of present customers to obtain additional consumers. The revenue account showed a satisfactory state of affairs. Under the heading of manufacture, a saving of more than £500 over the previous half year was made, notwithstanding an increased sale of nearly 10 million cubic feet. Raw material cost £129 more; but £490 was saved in working expenses, and repairs cost £228 less. Distribution cost rather more; but the remaining items were about normal. Taken altogether, the expenditure was £156 less than in the corresponding half year; and, in view of the increased production, this result was most gratifying. On the credit side of the account, the revenue from gas fell off by £458, as compared with the previous half year; but remembering the reduction of 3d. in the price charged, this, too, might be considered extremely satisfactory. Rental of meters and stoves showed an advance which, together with the improved prices obtained for residuals, accounted for an increase of £1145. The balance of £9157 carried to the profit and loss account was more than £500 in excess of the preceding half year. With regard to coal, the Company were at present very favourably situated; and the Directors hoped that, before it became necessary to renew their contracts, the market would have begun to return to its normal level. The Chairman, in conclusion, said: The prosperity and wellbeing of our country and of its manufactures has been in the past dependent greatly upon our coalfields; and this continues to be the case at the present day. We possess an article for which there is a great demand in other countries, and which they cannot produce themselves. Can we wonder now that the small duty which was previously charged has been knocked off, that our harbours are crowded with foreign shipping anxious to take away from us that which we only can produce? Not only does the foreigner pay no duty, but his demands necessarily keep up the prices which would otherwise tend to drop. We can obtain from no other nations similar advantages for ourselves.

The report and accounts were adopted, and a dividend for the half year at the rate of 6 per cent. per annum on the "A" and "C" stocks and of 4½ per cent. per annum on the "B" stock (less income-tax) was declared, with £1100 carried to the reserve fund.

Votes of thanks to the Directors, officers, and staff concluded the meeting.

Alluding to the changes effected during the half year in the engineering department, the Chairman, in the course of his speech, said: I cannot omit to refer to the serious loss the Company sustained by reason of Mr. Johnston's appointment as Engineer and Manager of the Brentford Gas Company. The Brentford Gas Company supply gas over a very considerable area, which has a population of 330,000, compared with ours of 60,000 or 70,000. They have an annual make of 2218 millions, and the consumers number 56,000, as against our 10,800. To be appointed to such a position shows the confidence the Brentford Company have in Mr. Johnston's ability, and is certainly also a reflex compliment to this Company. The zeal, energy, and ability of Mr. Johnston in the service of this Company have been acknowledged over and over again; and I can only say we heartily congratulate him, and trust he will have a prosperous and successful career in the future. Mr. W. B. Farquhar, our late Assistant Manager, who has been with us some years, has been appointed Mr. Johnston's successor; and having had experience of his capabilities, I believe we can fully rely upon him to carry out successfully the duties of such a responsible position.

DOVER GAS COMPANY.

Price Not to be Increased.

The report which the Directors of the Dover Gas Company submitted at the recent half-yearly meeting stated that the profit was sufficient to admit the payment of the full statutory dividend and leave a balance of £297 to be carried forward. It was, however, added that the gratifying results thus indicated were somewhat offset by the very heavy rise in the cost of coal. The Board had entered into contracts for the year's supply upon as favourable terms as it was possible to secure; but the extra cost was equivalent to an increased price of gas of 4d. per 1000 cubic feet, without considering any possible increased value of residuals. They were fortunate in having a sum of surplus profits, arising from past years' workings, which was available to meet any insufficiency of profits for dividends during the current half year; and therefore they did not propose to raise the price of gas at present. The mains in some districts were proving inadequate to meet the growing demands arising from the increased consumption in those districts; and a further small amount of capital might be required to provide the necessary outlay to supply the deficiency.

The Chairman (Mr. Willsher Mannering), in moving the adoption of the report and accounts, congratulated the proprietors upon the result of the past half-year's working. He pointed out that the accounts showed a profit (including £125 received from interest on investments) of £4610; and after providing for interest on loans and placing £250 as usual to the Trevanion Street holder suspense account, there remained a sum of £3859, which was sufficient for the full parliamentary dividend, and would leave a balance of £297 to be carried forward. The surplus was £329 less than in the corresponding half of 1906; and this decrease was owing to the higher cost of coal. It was satisfactory to note there had been a slight increase in the volume of business. The quantity of gas sold was 112,359,800 cubic feet, against 111,743,300 cubic feet—an increase of 616,500 cubic feet, equal to 0·6 per cent. This gave an increased rental of £106; and meter and stove rentals were also £23 more. Against this, residuals realized £132 less, due to the lower value of tar. The total revenue was £23,672, against £23,675. A comparison of the expenditure side showed an increase in coal of £458. A lesser quantity by 93 tons was used; and the cost was 9½d. per ton more. Purification was £98 less, wages £31 less, and repairs to works and plant £215 less, distribution and salaries £17 more, renewals of mains and services £256 more, repairs to meters £65 less, rates and taxes £25 more, public lamps £9 more, and management and sundries £22 less. The items on the whole, exclusive of coal, were less by £125. The total expenditure was £19,187, against £18,854, or an increase of £333. The number of consumers had gone up from 6297 to 6353; and the number of cookers and heaters on hire, from 4931 to 5946. There had been a small expenditure of £106 on capital account for new and additional mains and services. But for the serious rise in the price of coal, the affairs of the Company would have been in all respects eminently satisfactory. The Board had entered into fresh coal contracts for the year's supply at an average increase of 3s. 6d. per ton. This meant a total of £4000, and was equivalent to an increased price of gas of 4d. per 1000 cubic feet. Fortunately, there was a surplus profit balance of £4879 available for dividends; and the Directors also anticipated that the enhanced price of coke would help them to some extent. Then they might well suspend writing-down the automatic meter fittings account. This item was reduced to £14,170, for which there was full money value in 3652 complete automatic-meter supplies. Under these circumstances, they hoped to get through the twelve months without raising the price of gas. Beyond this, it was impossible to say anything. The Board contemplated laying a large and new main from the works to Frith Road. This would not only be ample for the neighbourhood, but act as a feeder to other mains, and ensure a more efficient supply generally.

The report was adopted, and a dividend for the half year at the rate of 7½ per cent., less income-tax, was declared. The Directors and officials were warmly thanked for their services; and this sign of confidence was acknowledged by the Chairman, the Resident Engineer (Mr. Raphael Herring), and Mr. E. C. Fielding, who expressed regret that his father, Mr. George Fielding (the Secretary), who had attended the meetings for 50 years, was not well enough to be there that day.

LARGEST GASHOLDER IN INDIA.

There has recently been erected in India, by Messrs. Clayton, Son, and Co., of Leeds, for the Oriental Gas Company, Limited, the largest holder in that part of the world; and it was formally put into use on the morning of the 21st ult. The holder is at the Company's works at Sealdah, which supply Calcutta with gas; and its capacity is a million cubic feet, which is sufficient for a day's requirements of the city.

The party who had been invited to be present at the christening and inauguration ceremony (which included the Municipal Commissioners) were welcomed by Mr. James C. Watson, the Manager, on behalf of the Gas Company. He explained that the work had been carried out by Messrs. Clayton without any serious accident; and it had given great satisfaction. There were two lifts, each about 150 feet in diameter and 30 feet deep. The tank and holder were constructed of mild steel, and weighed 742 tons. The tank contained about 14,500 tons of water; and having made several excavations to determine the condition of the ground for supporting such a weight, it was finally decided not to disturb too much of the subsoil, and to put in only 2 feet of cement concrete. The tank being equally loaded over its whole area was in its favour; and he was glad to say it was perfectly level, and there was no settlement whatever. The whole of the erecting was done with Indian labour, under European supervision; the quality of the work being excellent. The inauguration of the holder was, he hoped, also the inauguration of a new and promising future for the Gas Company; for they had now a supply of gas during the whole of the 24 hours, which meant a large accession of business for engines, cooking-stoves, and all sorts of appliances for heating, &c. Their thanks were due to the Hon. C. G. H. Allen (Municipal Chairman) for his kindness in coming to turn on the first gas from the new holder to the City of Calcutta. Knowing the keen interest Mr. Allen always took in everything that was conducive to the comfort and convenience of the citizens of Calcutta, he had great pleasure in asking him to undertake the duty of acting as sponsor to the new structure, and to perform the good old-fasbioned ceremony of breaking a bottle of wine for luck. He would ask him to name the holder the "Robert Hesketh Jones," after the Chairman of the Oriental Gas Company, and then to turn on the gas to Calcutta.

Mr. Allen remarked that, before turning the valves, he would like to say how warmly they welcomed this enterprise on the part of the Company, which was one of the great private enterprises the success of which was famous in Calcutta. The big structure before them was an example of what could be done; and everyone wished success to the Company. He then turned on the gas.

EXPLOSIONS IN ELECTRICITY CULVERTS.

Causes other than Coal Gas Responsible.

The City Electrical Engineer of Aberdeen (Mr. J. Alex. Bell) has prepared a report for the Gas and Electric Lighting Committee of the Corporation on certain explosions in electricity culverts which have lately occurred in the city. The following full summary of the report, which appeared in the "Electrician" for the 23rd ult., is worth reproduction, as, like the paper read by Dr. Bassett before the Liverpool Section of the Society of Chemical Industry, to which attention was recently directed in the "JOURNAL" (p. 572), it points to other causes than coal gas being responsible for these explosions.

The report states that on May 21 last an explosion occurred in the copper strip culverts in the east end of Union Street. Two manhole lids were blown up, and 8 yards of pavement between the two manholes were lifted; the flagstones being raised from 5 to 6 inches on one side. The two manhole covers were thrown into the air and both broken; and a section of one, falling on the copper strip, caused four or five short-circuits, resulting in some minor explosions. The main explosion, in Mr. Bell's opinion, was due to a service cable falling in on an end box and igniting the coal gas in the culvert. There was gas present in the culverts, and the Gas Department found a leak. The Electricity Department keep four men constantly at work examining culverts and manholes; and the section in which the explosion occurred was inspected on April 20, and the opposite culvert on May 2. No traces of gas were found on either of these dates. Since Jan. 1, 1905, 51 cases of gas leaks were reported by the Electricity Department to the Gas Department. The section damaged had pipes leading in at either end, it being an isolated section of culvert; and on carrying out the repairs Mr. Bell was able to take the opportunity of laying cable and filling in the culvert solid.

As far back as 1895, in view of some explosions which occurred in other towns in connection with their electric lighting installations, the Aberdeen Council consulted Sir Alexander Kennedy, who advised that efficient provision should be made to prevent escapes of gas from the mains. The first explosion in culverts in Aberdeen of which they had any record was on Feb. 15, 1897, which was admitted to be caused by gas. Explosions occurred at various intervals up to the autumn of 1903. In many cases after these explosions, there were distinct traces of coal gas in the culverts, and this was most marked when the effects of the explosion were of a severe nature. The remedies taken at that time were to advise the Gas Department where gas was traceable, and the periodical examination of the culverts. In short, up to that period the opinion was held that a fault in the cable or the blowing of a fuse was the cause of a spark, and that, owing to the presence of coal or sewer gas in the culverts, explosions resulted.

In the autumn of 1903, explosions occurred at much shorter intervals, and, in fact, were of such a nature as to necessitate immediate investigation with a view to their prevention. In the latter explosions it was found that a portion of the electric mains or service cable in the manhole concerned was burned out at the time of the explosion, and the presence of coal gas was not traceable in every case. To investigate the matter thoroughly, a culvert with boxes similar to those used in the streets was built in the electricity works yard, and a series of tests carried out. The Convener and the Gas Engineer were present at most of these tests; and Dr. Matthew Hay interested himself in the matter. In carrying out the tests, in the first place a service cable was built into the manhole and intentionally short-circuited—that is to say, a fault was put on it similar to what might occur in practice, and then the full-pressure current applied; the result being that the cable was immediately burned out and the manhole cover lifted. This at once showed that it was possible for an explosion to occur without the presence of coal or other explosive gas. The next step taken was to prove whether any explosive gas was generated from the insulating material by the intense heat of the fault; and it was found on experiment that a piece of bare copper wire, if short-circuited in the culvert, would create the same explosion, provided electrical energy sufficiently powerful were applied. These experiments tended to show that the explosions were in many cases brought about by the sudden heating and consequent expansion of the air in the manhole or culvert.

Experiments were next carried out with ventilated covers; but it was found that a 6-inch square hole cut in a manhole cover 26 in. by 24 in. was not sufficient to make any appreciable difference in the heigbt to which the cover was lifted. Culverts similar to those that are in use in Aberdeen are in some towns ventilated by means of fans; and where a continuous line of culvert is available, this method is in some respects satisfactory. Union Street culverts, however, were divided up into 24 different sections, having pipes, more or less with filled cables, connecting them. This method of ventilation was therefore impracticable. Experiments were also made with covers bolted down; but this was not found to be satisfactory.

As most of the explosions in 1903 were caused by the failure of a certain type of end connection on service cables (the failure being found to be due to moisture in the culverts attacking the insulation of the cables), a new form of end box was designed to minimize that trouble as far as possible, and some 500 service cables laid into consumers' premises from culverts were altered at considerable expense. There could be no doubt that this alteration had the desired effect, as for well over twelve months after this improvement was made there was not a single manhole explosion brought about by a cable fault.

To sum up the results of the experiments made and the experience gained by the explosions investigated, it was demonstrated first that if a cable failure occurred in a manhole, and sufficiently heavy current were available behind it, the box-lid would be lifted by the sudden heating and expansion of the air; secondly, if there were any sewer or coal gas present in the box, the explosion would be very much more serious. The system of laying electricity supply mains in the city from 1894 to 1896 was that known as bare copper strip drawn into concrete culverts. At present these culverts were laid in 13 streets, and four had culverts under both foot pavements. In all, there were 3½ miles of culverts. Radical alterations in supporting and insulating the copper strip and cables in these culverts had been made three times in the last eight years at considerable expense, and he (Mr. Bell) was unable to suggest anything that would remove the chances of explosion, short of doing away entirely with this type of distribution. It did not appear practicable to prevent coal gas leaking into the culverts from time to time. An interesting fact, Dr. Hay advised them, was that coal gas might, by filtering through a sufficient thickness of earth, lose its odorous constituents and become quite odourless, but would continue to retain its explosive elements. Even if it were possible to exclude gas from the culverts, there was still the danger of a box-lid being lifted by the sudden expansion of air caused by the heat from a cable fault.

Mr. Bell therefore recommended that the Committee should authorize him to replace the existing copper strip culverts by cables laid on the solid system, and that all important manholes on cable work should be replaced by section boxes placed above ground. In carrying out the work, he proposed to lay a distributing cable on the inside of the existing culverts, tapping on consumers as the work proceeded, then to lift the pavement over the culverts and remove road boxes and lay the feeder cables on the solid system inside the concrete culverts, filling in solid with earth before replacing the foot pavement. In estimating the net cost of the work (£8910), Mr. Bell allows for increasing the capacity of distributors and feeders to meet future requirements. Due allowance is made in the estimate for metal, &c., recoverable.

The Council have adopted Mr. Bell's recommendations.

NEW CATALOGUES.

We have received from Messrs. D. Hulett and Co., Limited, of 55 and 56, High Holborn, W.C., a new supplementary catalogue of gas-fittings for the season 1907-8. The fittings illustrated are for inverted and upright incandescent burners, and are of all kinds and prices.

The Lunken Valve Company, of 35, Great Dover Street, S.E., forward an illustrated description and catalogue of their external spring indicators, and other goods. The indicator named is made in three sizes, to suit all purposes, for speeds up to 1500 revolutions per minute.

Messrs. Falk, Stadelmann, and Co., Limited, of Farringdon Road, E.C., have sent us a copy of their new "Veritas" incandescent light list. The catalogue illustrates everything that is required so far as incandescent burners, mantles, glass, and accessories are concerned; but fittings will form the subject of a separate list.

The New Inverted Incandescent Gas-Lamp Company, Limited, of Farringdon Avenue, E.C., have issued their new season's catalogue of "Nico" inverted incandescent gas burners, fittings, arc lamps, &c. A feature, of course, is the regulator for the adjustment of the gas supply to either inverted or upright incandescent burners which was described in the "JOURNAL for July 2 last (p. 20). The complete manner in which the inverted burner lends itself to a combination of the ornamental with the useful, is excellently demonstrated by the numerous illustrations of the Company's fittings.

SHEFFIELD WATER COMMITTEE.

Resignation of Alderman Gainsford.

When the minutes of the Water Committee came up for confirmation at last Wednesday's meeting of the Sheffield City Council, reference was made to a letter from Alderman Gainsford intimating that he would next November resign the chairmanship.

The Lord Mayor (Alderman R. Styring) said he voiced the deep regret of the Council that the state of Alderman Gainsford's health compelled him to resign the chairmanship of the Water Committee, which he had held with so much profit to the community and so much credit and distinction to himself during the last eighteen years. No amount of money would have led to Alderman Gainsford giving greater care and attention to the undertaking ; and as the Manager of the concern before it was purchased by the Corporation received £2000 a year, when the income was less than half what it was now, it was clear that Alderman Gainsford had rendered voluntary services to the city for which a company would have been ready to pay something like £30,000 or £40,000. It was a somewhat remarkable feature in his character that, combined with the very great caution which distinguished him, there had at the same time been manifested a very ready inclination and disposition to act on progressive lines. This was well brought out in connection with the undertaking of the Langsett scheme, and perhaps in a more marked way in regard to the laying out of Rivelin Road and the development of the land adjoining, which he considered in time to come would prove of very great advantage to the community. It was also manifested generally in connection with the more recent transaction of the Wyming Brook Estate ; and the same thing operated in connection with the enormous scheme now proceeding in the Derwent Valley. When it fell to his (the Lord Mayor's) lot in the very earliest stages, before anything had really been done, to suggest to Alderman Gainsford that an effort should be made to obtain part of that water for Sheffield, he took it up with the very greatest readiness. There was not the least trace of the obstructive or lethargic spirit ; and they made journeys together to London before any mention was made of the matter in public, and had interviews with Parliamentary Agents with a view to seeing if steps could be devised for bringing about what they felt would be to the interests of the city. In the later proceedings, too, when the matter got into Parliament, and it became necessary to fight one of the most keenly fought parliamentary contests ever conducted in this country, Alderman Gainsford devoted himself to it with might and main, with the result that to Sheffield was secured a very substantial portion of the water.

Mr. Bennett also eulogized Alderman Gainsford's services, and said they would be be only too glad to keep him as Chairman of the Derwent Water Board as long as he chose to occupy that position.

Electricity Failure at Manchester.—As is quite usual in these cases, it was on a Saturday night that the Manchester electricity supply went temporarily on "strike." Local reports state that scores of tramcars *en route* to and from the out-districts were brought to a standstill ; and many shops in the city proper were compelled to close at an earlier hour than usual, owing to the breakdown.

BIRKENHEAD CORPORATION WATER SUPPLY.

The New Water Act.

At a Meeting of the Birkenhead Town Council last Wednesday week, Alderman B. Jones, referring to the Water Act just obtained by the Corporation, said Birkenhead would obtain a supply of water for a long time to come, and by a short Act of Parliament the Glan Alwyn reservoir could be extended. Alluding to the negotiations with Liverpool, he said he had come to the conclusion that, though the Liverpool scheme would have been a little cheaper in the first years, Liverpool and Birkenhead would, sooner or later, have required all the water they could get from their own schemes. In the bargain with Chester, Birkenhead was not in a disadvantageous position. The Corporation began with 26 petitions against their Bill ; and at the conclusion there was only one outstanding. With regard to the Alwyn reservoir, quite two-thirds of the land would not be purchased at all ; and what was being taken from the landowners was certain easements to go upon their land to construct works. All the Corporation wanted was that the water should be pure that flowed into the reservoirs. In this way they had secured it without buying the land. The speaker went on to refer to the opposition of the Dee Conservancy and the Dee Fishery Board. He said the Corporation did not want Wallasey to be cut out of the Bill, because the two communities had been friendly. Liverpool had an agreement with Wallasey, and did not want to lose the benefit of it. At one time or another, Wallasey would want to get water by means of the Birkenhead Act. Birkenhead had been shut out of Wallasey, but only to this extent—that the Council could not undercut themselves in supplying Wallasey. It was not a serious matter, and Birkenhead had not the slightest objection to this, or to the clause referring to the period when Wallasey could ask for a supply. He concluded by alluding to the cordial relations existing between the members of the Parliamentary Committee of the Corporation, and to the arduous labours of the Town Clerk (Mr. Alfred Gill) in connection with obtaining the Act.

Gladwell's Dustless Road System.

The current number of the "Builder" mentions as a comparatively inexpensive system of making waterproof and dustless roads that which has been employed with considerable satisfaction in the Eton neighbourhood by Mr. Gladwell, the Engineer to the Rural District Council. In one important respect the method of construction differs from that generally adopted by engineers who seek to prevent the penetration of water and the manufacture of dust by applying tar or kindred substances to the surface. Instead of attempting to bind and preserve the metal with the aid of a preparation which has to be worked downwards, Mr. Gladwell uses granite chippings treated with a species of tar from which the light oils have been separated, and covers the tarred bed with granite macadam. The theory, and it is said the practical effect, is that (by the pressure due to rolling) the tar works up from below into the voids between the particles of macadam, binding the whole into a compact mass. Experience at Eton shows that the surface is quite satisfactory, and that roads made in the way described actually cost less, when maintenance is taken into account, than macadam roads, where the so-called binding materials are simply dust and water.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 751.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.. . . .	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Aug. 29	14	Bournemouth Gas and Water 10 p.c. . .	27—28	..	5 0 0
51,810	10	,,	7	Bournemouth Gas and Water B 7 p.c. .	16¼—16¾	..	4 3 7
53,200	10	,,	6	Bournemouth Gas and Water Pref. 6 p.c.	14½—15½	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	247—252	+2	4 19 2
300,000	,,	,,	9½	Do. New . . .	185—190	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref. .	115—120	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb. .	100—103	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c. .	116—119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c. .	87—90	..	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
150,000	20	July 12	8¼	Cagliari, Ltd.	26½—27½	..	6 0 0
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord. . .	106½—108½	..	4 12 2
1,443,280	Stk.	,, 29	5$\frac{2}{10}$	Commercial 4 p.c Stk. .	101—106	..	4 18 1
560,000	,,	,,	5	Do. 3½ p.c. do. .	98—103	..	4 17 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk. . .	123—125	..	4 8 0
55,000	,,	—	4	Do. Deb. Stk. . . .	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd. . . .	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17½—18½	..	4 17 4
15,182,590	Stk.	Aug. 15	4$\frac{4}{10}$	Gas-light and Coke 4 p.c. Ord. . .	93—95	..	4 12 7
2,600,000	,,	,,	3½	Gas-light and Coke 3½ p.c. max. . .	86—88	..	3 19 7
3,799,735	,,	,,	4	Gas-light and Coke 4 p.c. Con. Pref.	103—106	..	3 15 6
4,193,975	,,	June 13	3	Gas-light and Coke 3 p.c. Con. Deb.	81—83	..	3 12 3
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	93—98*	+½	5 2 0
82,500	,,	,,	6½	Do. do. 5 p.c.	114—117*	+1¼	5 11 1
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental .	174—176	..	4 10 11
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93	..	3 15 3
195,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c. .	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A . .	218—220	+1	4 10 11
718,100	,,	,,	7	Do. B .	160½—161½	..	4 6 8
152,736	Stk.	Feb. 14	7⅝	Maidstone 5 p.c. . .	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb..	101—103	+1	4 17 1
250,000	100	,,	4½	Met. of Melbourne 4½ p.c. Deb.	101—103	+1	4 7 5
541,920	20	May 30	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	107—108	..	4 5 7
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19—20	..	5 0 0
55,940	10	,,	7	Do. 7 p.c.	12½—13½	..	5 3 8
300,000	Stk.	Apl. 26	8	Oriental, Ltd. . . .	140—145	..	5 10 4
60,000	5	Sept. 13	7	Ottoman, Ltd. . .	5¾—6¼*	..	5 12 0
398,490	5	May 15	7	Primitiva Ord. . . .	6¾—7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref. .	5—5¼	+⅛	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb. .	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord. . . .	13—13½	..	5 18 6
312,650	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd. . . .	13—13½	..	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb. .	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	246—248	..	4 0 8
209,984	,,	,,	10	Do. B	246—248	..	4 0 8
523,500	,,	,,	10	Do. C	246—248	..	4 0 8
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	119—121	..	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159—161	..	4 19 5
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	115—118	..	4 13 3
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	117—120	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord. . .	105—110	..	4 10 11
120,000	Stk.	Aug. 15	6¾	Tottenham and Edmonton A 5 p.c. .	120—123	..	5 9 9
398,940	,,	,,	5¼	Tottenham and Edmonton B 3½ p.c. .	100—103	..	5 1 11
149,470	,,	June 27	4	Tottenham and Edmonton 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c. . .	—	..	—
255,636	,,	Aug. 15	6½	Wandsworth and Putney B 3½ p.c. . .	128—133	..	4 17 9
75,000	,,	,,	5⅝	Wandsworth and Putney C 3½ p.c. . .	—	..	—
80,075	,,	June 27	3	Wandsworth and Putney 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord. .	101—104	..	4 18 6
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	118—120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Works Committee of the Edinburgh and Leith Gas Commission on Monday resolved that on all accounts after the usual accounts in October, the price of gas he increased by 3d. per 1000 cubic feet. The price will then be 3s. Gas supplied through prepayment meters will remain as at present—4s. 3d. per 1000 cubic feet; and the price of gas for public lighting does not come up for re-adjustment till April of next year.

In the Dunfermline Town Council on Monday, the Gas Committee recommended acceptance of the offer of Messrs. R. Dempster and Sons, Limited, of Elland, for supplying and fitting up a coal-breaking machine at the works for £299 15s. Consideration was resumed of plans for new sulphate of ammonia plant and the housing of same, with workmen's room and lavatory attached. The Engineer stated that the probable cost would be about £900; and the Committee agreed to recommend that the work be proceeded with at once. The recommendations of the Committee were agreed to.

The Gas Committee reported to the Hamilton Town Council last Tuesday that the Assessor had fixed the valuation of the gas-works at £5266—an increase of £1226, but that the Manager (Mr. J. Ballantyne) had explained that the valuation was based upon profits, and it appeared to he in order.

In the Wishaw Town Council on Monday, the Gas Committee recommended: (1) That all manufacturers within the hurgh he charged the same price for gas used for manufacturing purposes as is charged for power, provided that they put in a separate meter, which will be supplied by the Council at a reasonable rent; (2) that the Gas Manager be instructed to purchase no more gas-cookers in the meantime, without the matter first coming before the Committee, and that no such article he supplied to consumers until their names have been submitted to, and approved of by, the Gas Committee; and (3) that the Council horrow £3000 to meet current capital expenditure. The Committee reported that they had received a deputation from feuars at Netherton, who asked for information as to the price to be charged to private consumers, and that they informed the deputation that it would he 3s. 6d. per 1000 cubic feet, in addition to which there would be payable on ordinary meters a hire of 2s. 6d. per annum; and that, as regarded consumers using prepayment meters, they would be charged at the rate of 3s. 9d. per 1000 cubic feet until such time as they had consumed 10,000 cubic feet. The deputation considered the rate too high, and that, in any event, they thought they should get meters supplied free, and, further, that, in the event of the price of gas within the burgh being reduced from 2s. 11d., a proportionate reduction should he given to consumers in the Netherton district. The Committee informed the deputation that their views would be reported to the Council. The Council, after some discussion, sent the subject back to the Committee, with power; but with instructions that no alteration was to he made in the price of gas, and that ordinary meters were to be charged a rent starting at 2s. per annum, and increasing according to size. Otherwise the recommendations were adopted.

The Arhroath Town Council on Monday considered the annual financial statement which was submitted by Bailie Thomson, the Convener of the Finance Committee. In the course of his statement, he said, dealing with the gas accounts, that their revenue from gas sold amounted to £12,491; from residual products, to £2828; and from other sources, to £92—making a total revenue of £15,411. The expenditure amounted to £11,129, leaving a balance of £4282. They had in hand at the beginning of the past year £639, which made a total halance of £4921. From this there had been paid annuities, £1345; interest on loans, £694; sinking fund, £575; carried to contingency and depreciation account, £1345; and to the Harbour Trustees, £250—together £4209—leaving a balance of £711 at the end of the year. This showed very excellent results, especially when they took into account the very great difficulty the Manager had had on account of the tremendous rise in the price of coal. An annuity of £7 had heen redeemed out of the sinking fund, at a cost of £203 19s. 8d.; and a loan of £1180 had been repaid. There was a balance left in the sinking fund of £217. In the contingency and depreciation account, the following amounts had heen applied during the year: Scrubbing plant, £794; new boiler, £458; and extension of purifiers, £59—in all £1311. There was left in the fund at the end of the year, £37.

The Gas Committee of the Kilmarnock Town Council on Wednesday recommended that, in view of the large increase in the price of coal, the price of gas be increased hy 2½d. per 1000 cubic feet—the increase to take effect ahout the middle of September, when the next survey commenced. After discussion, it was agreed not to increase the price.

The Monifieth Town Council had before them on Tuesday plans prepared hy Mr. A. Morton Fyffe, of Dundee, for the extension of the gas-works. Bailie Fenton, the Convener of the Gas Committee, in moving the adoption of the plans, said that during the few years the works had heen under the control of the Town Council, the gas consumed had gone up from 5 to 7½ million cubic feet. The proposed extensions would cost about £1900. It was moved that the matter he delayed till after the Novemher election; but the Council decided that the work should go on.*

The Directors of the Kennoway Gas Company have resolved, on account of the rise in the price of coal, to increase the price of gas hy 1d. per 1000 cubic feet, to resume charging for meter-hires, and to reduce the salary of the Manager.

The Selkirk Town Council held a special meeting on Monday to consider as to the adoption of the Burghs Gas Supply (Scotland) Act of 1876. Provost Sim proposed that the date of the meeting of the Council to consider and, if so advised, to confirm the resolution to adopt the

* Some particulars from Mr. Fyffe's report, and a plan showing the proposed extensions, will be given in an early issue.—Ed. J. G. L.

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Oldest Makers of High-Class Exhausting Machinery of all Capacities and for all Purposes.

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Act, which he moved, should be Nov. 25. It was, he said, entirely a formal matter, and did not bind them to anything. They had not yet been able to come to any agreement with the Gas Company. They had made an offer (which they presumed the shareholders were considering); and it would be most unwise for the Council to discuss the advantages or disadvantages of that proposal in the circumstances. If the offer were accepted, the very fullest information would be placed before the ratepayers. Mr. Reekie said there was no reason for the motion, seeing there was great opposition in the town to the taking over of the gas-works. He moved that they do not resolve to adopt the Act. Mr. Roberts pointed out that they were only preparing the ground for the submission of the question to the ratepayers. There was no doubt whatever that, at a certain price, the acquisition of the gas-works would be a very good investment for the town. He thought it was unwise for anyone to say that there was great opposition in the burgh. Only two councillors voted for the amendment.

At the meeting of the Denny Town Council on Tuesday, it was reported that the Parish Council had agreed to a deduction of $33\frac{1}{3}$ per cent. from the valuation of the gas-works for five years in respect of improvements at the works.

The St. Andrews Gas Company held their annual meeting on Friday—ex-Bailie Aikman in the chair. The Manager submitted the seventy-third annual report, showing a profit on the year's transactions of £1771, which is considerably in excess of last year. There was an increase during the year of 80 consumers. The works and apparatus were in an efficient state of repair, and were thoroughly up-to-date. The Electricity Supply Company had not interfered in any way with their business. It was proposed to pay £3 per share as dividend, free of income-tax, and to carry forward £487 19s. 3d. The Chairman took the opportunity to refer to the great loss the Company had sustained by the death of their Manager, Mr. J. Hall. He thought the report a very satisfactory one. The business had increased in spite of competition, and they had every reason to be satisfied. He referred to the rise in the price of coal, and said that, thanks to the advice of their new Manager, Mr. R. Hall, they had bought early, and secured a stock sufficient to last till May next, when the advance had only reached 2s. 6d. per ton. This should have meant an increase of 4d. per 1000 cubic feet of gas; but the Company had borne one-half the loss, and had only raised the price of gas by 2d. He moved the adoption of the report. A high compliment was paid to the Manager and staff.

Success of the Altham (Accrington) Boring.—We learn that a short time ago water was struck in the boring at the Altham new waterworks, belonging to the Accrington District Gas and Water Board; and a practically unlimited supply of excellent water is assured. The boring had been sunk 117 feet; and when the grey rock, 16 yards thick, had been penetrated 15 inches, the water spurted out, to the delight of Mr. D. C. Dewhurst, the Chairman of the Board, and Mr. Charles Harrison, the General Manager, who happened to be present. The boring through the 48 feet of grey rock is proceeding.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 14.

Sulphate of Ammonia.

The publication of the August export figures, showing a very marked increase upon those for August, 1906, has checked any tendency towards weakness, and parcels out for tender have realized full prices, though second-hand sellers have been offering at less money. The closing quotations therefore remain £11 15s. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. Direct orders, however, are scarce, and the buying is still for the most part for covering purposes. There has been more inquiry for delivery ahead; but buyers still jib at the makers' prices, which remain £12 2s. 6d. per ton for November-April, and £12 5s. per ton for spring months.

Nitrate of Soda.

There is no alteration in the position of this article, spot prices remaining 11s. $1\frac{1}{2}$d. per cwt. for 95 per cent., and 11s. $4\frac{1}{2}$d. for refined quality.

LONDON, *Sept.* 16.

Tar Products.

Markets for tar products are quiet, and there is not very much business doing. Pitch is decidedly easy. Manufacturers are willing to sell at 26s. on the east coast to the end of the year; but in most cases they cannot obtain this figure. In Liverpool, pitch has been offered at 27s. without success. Continental buyers are still holding off the market. In most cases they will only purchase for next season's delivery, and that upon terms which hold out no inducement to dealers to accept same. The South Wales buyers are fully supplied to the end of the present year, and report having bought all over 1908 at low figures. Creosote is steady. London manufacturers ask from $2\frac{3}{4}$d. to 3d., according to position and quality. In the Midlands, 3d. is the usual figure asked for; while in the North, some quantity of business has been done at $2\frac{3}{4}$d. for delivery to the end of the year. Benzol, 90 per cent., is quiet. Manufacturers are still willing to sell at $8\frac{1}{4}$d. to the end of June next, but cannot get any buyers at this figure, while 8d. per gallon is reported to have been accepted for prompt delivery in London, though the majority of manufacturers quote higher figures than this. Benzol, 50-90's, is quiet. Some quantity has been sold in London at prices varying from $8\frac{3}{4}$d. to 9d. per gallon; but in the North, lower figures have been accepted. There is nothing doing in toluol. Consumers have still very large stocks to work off. Solvent naphtha is quiet. Business has been done in the North at 1s. per gallon; while country makes have been offered in London at 1s. 1d. The majority of London manufacturers ask 1s. 2d. per gallon. Carbolic acid is steady. There are sellers at 1s. $8\frac{1}{4}$d. for January-June; but the Continental consumers will not pay this figure. Crystals are still quiet and difficult of sale.

The average values during the week were: Tar, 15s. 6d. to 19s. 6d., *ex* works. Pitch, London, 27s.; east coast, 25s. 6d. to 26s.; west coast,

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Show Rooms,
Park Road.

TELEPHONES
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GAS OFFICES 234
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ALL REPLIES TO BE ADDRESSED
J D ASHWORTH.
GENERAL MANAGER

Portsmouth 3rd August 19 07.

Messrs Bland & Co,

London.

Gentlemen,

In reply to your inquiry regarding Blands Inverted Gas Burners I have much pleasure in adding to the testimony of same.

I think it is sufficient recommendation in itself when I say my Company have fixed upwards of 3,000 of these burners in this town during the past year. They are of a decorative design and give a most satisfactory illumination at an exceptionally low gas consumption. Regarding cost of maintenance I have found this exceptionally low, in fact far below that of the up-keep of the ordinary vertical Incandescent Gas Burner. In conclusion I have no hesitation whatever in saying that I can strongly recommend them to Gas Lighting Engineers.

Yours faithfully,
J. D. Ashworth
General Manager.

Facsimile of letter received by Bland & Co., 63, Queen Victoria Street, London, and Manchester.

25s. to 26s. Benzol, 90 per cent., 8d. to 8¼d., casks included; 50-90 per cent., 8½d. to 9d., casks included. Toluol, 10d. to 10½d., casks included. Crude naphtha, 4d. to 4¼d., naked; solvent naphtha, 1s. to 1s. 1½d., casks included; heavy naphtha, 1s. 0½d. to 1s. 1½d., casks included. Creosote, London, 2¾d. to 2⅞d., naked; North, 2⅝d. to 2⅞d., naked. Heavy oils, 3⅛d. to 3¼d., naked. Carbolic acid, 60 per cent., 1s. 8d. to 1s. 8¼d., casks included. Naphthalene, £6 10s. to £10 10s., packages included; salts, 35s. to 40s., packages included. Anthracene, "A quality," 1½d. to 1¾d., casks included.

Sulphate of Ammonia.

This article is quiet, and prices are without any change. The principal London Gas Companies still quote £12 2s. 6d. to £12 5s., but other makes have been sold on Beckton terms at £11 15s., for delivery to the end of the year. In Hull, business has been done at £11 15s. to £11 16s. 3d. for the best makes; but some quantity of discoloured has been sold at £11 12s. 6d. In Leith, business has again taken place at £12; but the majority of manufacturers ask 2s. 6d. over this figure. In Liverpool, the ruling value may be taken as £11 16s. 3d. to £11 17s. 6d.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Colliery owners report that the general demand for coal of all sorts is undiminished. At some of the sidings empty waggons are waiting to be filled, and, as one manager said, "We cannot get them filled." The miners seem to be taking matters somewhat indifferently. While there is no lack of work, they seem to be satisfied with three or four days' labour per week. Holidays are taken indiscriminately. At one large colliery, the average absentees number from 60 to 70 per day. The export trade is described as "extraordinary." From Friday last, the advance of another 5 per cent. in wages took effect; and this brings up the average to something like 50 per cent. above the original minimum. Gas coal and cannel are in slow request. "Coalite" seems to be as dead as a door nail. The name is never heard. The average prices at the pits in the Manchester district are: Best house coal 15s. to 16s. 6d. per ton, secondary 14s. to 15s., common 12s. to 13s. 6d., burgy 10s. 6d. to 11s. 4d., best slack 9s. 6d. to 10s. 4d., medium 8s. 6d. to 9s., lower qualities 7s. 9d. to 8s. 4d., coal for shipping 13s. to 14s. 6d. f.o.b. at the tips. Furnace coke is 17s. to 25s.

Northern Coal Trade.

There has been some ease in the northern coal trade, due in part to the delay in the arrivals of steamers, so that the shipment of coal has been retarded, and partly to the milder weather, which has checked consumption in some branches of the trade. Steam coals have been weaker, chiefly through delay in exportation; but there is now a partial recovery. Best Northumbrian steams vary from about 16s. 1½d. to 16s. 4½d. per ton f.o.b. For second-class steams, the quotation is from about 15s. to 15s. 6d., and steam smalls are rather scarce at from about 10s. to 10s. 6d. In the gas coal trade, the demand is growing heavier, more especially for home use; and the exports of gas coal have been far above the average this season. Good Durham gas qualities vary from 14s. 6d. to as high as 16s. per ton f.o.b.; but there is some variation in prices when the delivery is well forward. As to new contracts, there are not so many of these to record; but a sale, for delivery over next year, is reported at about 14s. 6d. per ton f.o.b., though the quantity is not stated. In the coke trade, there is a good demand. Gas coke feels the benefit of this—the enlarged production being well taken up; and the price is about 19s. 6d. to 20s. per ton f.o.b. Some inland gas-works have slightly increased the price of coke for domestic use.

Scotch Coal Trade.

The market, particularly the foreign section of it, continues to be very active, and prices for all sorts are firm. The prices quoted are: Ell 14s. 6d. to 16s. 6d. per ton f.o.b. Glasgow, splint 15s. to 15s. 6d., and steam 14s. to 14s. 3d. The shipments for the week amounted to 324,323 tons—a decrease of 655 tons upon the preceding week, but an increase of 42,453 tons upon the corresponding week of last year. For the year to date, the total shipments have been 10,058,583 tons—an increase of 666,887 tons upon the corresponding period of 1906.

Alleged Nuisance from a Gas-Works Ended.

Dr. T. Orme Dudfield, Medical Officer of Health for Kensington, in his annual report, which has just been issued, says that complaints are received every year of effluvium nuisance from the gas-works at Kensal Green. There could, he adds, be no doubt as to the genuineness of the complaints, which obtained confirmation from Willesden. The inhabitants of that district suffered when Kensington people had no ground for complaint, and *vice versâ;* the incidence of nuisance varying with changes in the direction of the wind. That the cause of nuisance was more or less under control, would, he says, appear from the intermittency of the complaints, and as the smells were at times not perceptible to any noxious degree in the vicinity of the works. In March, 1906, several complaints were received from (among others) residents in St. Quintin Avenue and other streets in the vicinity. Written intimations of nuisance were served on the Secretary of the Gaslight and Coke Company, and also on the Resident Engineer, who attributed the offensive effluvia to the defective condition of one of the scrubbers, then under repair—the top having been taken off for the purpose. It was stated that the lime purifiers were emptied when necessary between 2 and 3 a.m.; that every effort was made to reduce any offensive smells to a minimum; and that nuisance from this cause would cease in a few weeks, when the process of purification of the gas by lime would come to an end, and oxide of iron only be used for the purpose. The change having been brought about, no further cause for complaint arose; and therefore there was no occasion to give effect to the directions of the Public Health Committee to institute proceedings.

PARKINSON'S GAS-FIRES.

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Electric Lighting Complaint at Dudley.

The Dudley Town Council have passed a resolution requesting the Streets, Tramway, and Lighting Committee to report as to the best methods for improving the public lighting of the borough. The member who introduced the motion remarked that the complaints respecting the present system of lighting the main roads with arc lamps were so general, and the defects of this method of illumination so obvious, that the time had arrived when the whole question should be dealt with by the Council. So far as the arc lamps in the Market Place were concerned, it appeared to him that they were more in the nature of illuminants of the sky and the housetops than of the thoroughfare itself. These arc lamps were not only unsatisfactory in regard to their action, but also in respect of their distribution. In some parts of the borough, if one of them went out, there was a space of about a quarter of a mile with no intervening illuminant. If the borough was to be lighted by electricity, it was important there should be a thoroughly good system in operation. He suggested that, in place of the existing arc lamps, there should be substituted smaller ones, using about half the current. These smaller lamps could be placed on the tram-poles, and be fed by two distinct cables; so that if one became fused, half the lamps would continue alight. They could also be duplicated at important junctions, and so ensure a light always at dangerous points. The cost of carrying out the scheme he proposed would be £1200, representing an annual charge in connection with interest and sinking fund of not more than £90. This, he thought, was very small when compared with the great public benefits that would be derived from the alteration.

Gas Explosion at Hampstead.—As the result of a gas explosion in a house at South Hill Park, Hampstead, Mr. Lambert, the occupier, was so severely burnt that he had to be removed to the hospital; while numerous windows were broken. On its way to the spot, the steam fire-engine skidded and overturned; and two firemen were injured.

Mishap at Highgate Reservoir.—The reservoir which has just been constructed for the Metropolitan Water Board in the valley between Fortis Green and Highgate Woods, and which is intended to supply with water from Staines the large population which is growing up in this district, has been the scene of a mishap the remedying of which will entail considerable outlay. The building of the reservoir was commenced during the time of the New River Company; and on its completion recently, it was examined and handed over by the Contractors to the Board. A few days afterwards, however, one of the walls gave way, owing to the pressure of the earth on the outside. It is conjectured that if the reservoir had been full of water, the weight would have counterbalanced the pressure of the earth on the other side, and the mishap would not have occurred. The wall is to be rebuilt at a cost of between £6000 and £7000; and a commencement has been made with the work of demolishing the damaged wall, by means of charges of dynamite.

Welsh Water for London.—A correspondent of the "Engineer" writes: In a journey through the Rhayader district, where the great watershed for Birmingham is situated, I found that out of all the thousands who were employed there for twelve years, only 130 men remain, and these will very likely be lessened. At one time over £2000 circulated fortnightly in wages; and the withdrawal of this has told seriously on the district. It was, in the opinion of Sir Alexander Binnie, that from this neighhourhood London would get its supply; and there is a rumour now current that this is not abandoned. The watershed suggested impinges on the Towy, the Irvor, the Wye, and the Usk. But the matter is still one of theory; and I cannot learn of any more practical step than taking the rainfalls and the height of floods at certain seasons. London may be wealthy enough for any expenditure; but the difference in the estimate of the property value of the Bala and the Radnorshire district must be very large. The latter, with its mineral springs, is of exceptional value.

Bradford and the Gas-Works of the Ripley Trustees.—The Bradford City Council, on the recommendation of the Gas Committee, have decided to purchase for £15,000 from the Ripley Trustees their private gas-works at Ludlam Street. Of the production of these works, 89 per cent. is used for trade, and 11 per cent. for domestic purposes. We learn from the "Yorkshire Observer" that nearly fifty years have elapsed since Sir H. W. Ripley, anticipating the needs of the large estate that he was developing, had a gas plant laid down in Ludlam Street, which has since supplied gas, not only for domestic and industrial purposes, but for lighting streets on the estate. Situated within easy access of a coal depôt, and with an annual production of about 40 million cubic feet of gas, the undertaking is one of considerable value; and seeing that the larger portion of the estate belonging to the Ripley Trustees is still undeveloped, this value in the course of years would no doubt be greatly enhanced. At various times negotiations have passed between the owners and the Gas Committee of the Corporation with a view to the purchase of the works by the City Council.

Brampton and the Geltsdale Water Scheme.—At the last meeting of the Brampton Rural District Council, it was stated that a settlement had been arrived at in regard to the action brought by the Council against the Carlisle Corporation for damage done to the roads in the Brampton district on account of the extraordinary traffic due to the Geltsdale water scheme. The Chairman (Mr. W. Dobson), in making the announcement, said that negotiations had been going on between the Solicitors to the Corporation and the two Contractors, with regard to the claim. The Committee had not prepared a written report; but they were happy to say they had made a very satisfactory settlement. The defendants had to pay to the Council £1100, together with the taxed costs. This was to cover the claim for damages done to the roads during the existence of the present contract, which was not concluded. The Council would remember that the expenditure was £1673; and the claim was put in at two-thirds of this amount, which, roughly, was £1100. They had not altered their position at all; and finally the Solicitors acting on behalf of the two Contractors jointly with the Corporation had agreed to their terms. The Council at once confirmed the settlement.

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NOTTINGHAM.

Tees Valley Water Board Act.

The Tees Valley Water Board have approved of a long report by the Finance Committee on the Tees Valley (Consolidation) Act, 1907. The principal item of interest in the report was that relating to the sale of water to large consumers at 3d. or 3½d. per 1000 gallons; and it was stated that, after several meetings between a Committee of the Board and a Committee appointed by the large consumers, it was arranged that until Dec. 31, 1914, or the earlier completion of the Grassholm reservoir, the charge to large consumers inside the borough of Middlesbrough should be 4½d. per 1000 gallons, and to those outside the borough 4¾d. After that date, the charge to large consumers inside the borough is to be 4d. per 1000 gallons, and to those outside 4½d. The Committee representing the large consumers proposed a sliding-scale terminating, in a certain number of years, at 3d. per 1000 gallons inside the borough and 3½d. outside; but they ultimately accepted the proposals embodied in the Act, which provided that any surplus revenue in any year had to be applied to the reduction of the charges to the domestic consumers only. An estimate of the financial position of the Corporations of Middlesbrough, Stockton, and Thornaby under the provisions of the Act showed that if the Act had been in force during the whole financial year ending March 31, 1908, there would have been a surplus for discount or reserve fund of £8463; whereas provision was made in the estimates to meet a deficit of £25,575. At the meeting of the Board at which the matter was considered, Sir Samuel Sadler said the new Act meant a perfect revolution in the conduct of the Board's affairs. They were now about to convert a loss into a profit. The ratepayers would have great cause for congratulation that they were to be relieved from providing many thousands of pounds a year towards the water undertaking. Their General Manager, Mr. D. D. Wilson, had, in connection with the Bill, surpassed himself in the way he had conducted affairs. He moved a vote of thanks to Mr. Wilson for his services; and this was carried.

Sale of Gas Stock.—At a local auction sale, Mr. Frank Ruff a few days ago disposed of £7500 of "B" stock in the Long Eaton Gas Company. After the conditions of sale had been read by Mr. George Stevenson, the Engineer and Secretary of the Company, the stock was offered in lots of £100 each. The first two lots realized £110 each, the second two £105 each, and the rest were knocked down at £100.

Interest on Local Loans.—The Lords Commissioners of His Majesty's Treasury gave notice in last Friday's "Gazette" that, in pursuance of the powers conferred upon them by the Public Works Loans Act, 1897, they have been pleased to direct, by their minute of the 9th inst., that on loans advanced out of the Local Loans Fund on the security of local rates subsequent to the date of that minute there shall be chargeable, in lieu of the rates of interest fixed by the Treasury minute of March 3, 1904, the following rates of interest: Not exceeding thirty years, 3½ per cent. per annum; and not exceeding fifty years, 3¾ per cent. per annum.

Sandiacre Gas-Works to be Purchased.—It is stated that negotiations which have been going on for some time between the Long Eaton and Sandiacre Gas Companies for the purchase by the former of the Sandiacre undertaking have been concluded; the Long Eaton Company having secured the Sandiacre Company as a going concern.

Price of Gas at Cobham.—Last Tuesday, a public meeting was held to protest against the increased charges of the Cobham Gas Company. Previously the gas was supplied at 4s. 9d. per 1000 cubic feet; and this has now been raised to 5s. It was decided to address a letter to the Gas Company complaining of the increase, and further threatening to use another source of illuminant as much as possible should the price be maintained.

The Kinder Water-Works at Stockport.—The Stockport Town Council, on the recommendation of the Water Committee, have decided to complete the Kinder Water Scheme by means of direct labour, instead of again placing it in the hands of a Contractor. As the result of reports made by their Engineers (Messrs. Hill and Son), and of their own observations, the Committee are convinced that it will be possible to make a water-tight dam in the valley; and the work is to be pushed on with all speed, so that if possible it may be finished within the period stipulated in the Act.

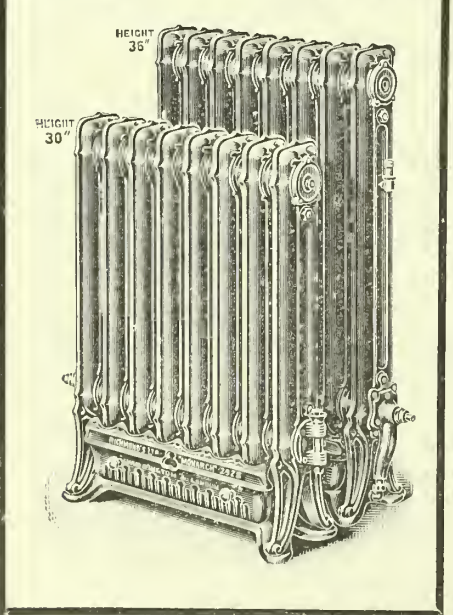
Charges for Water at Yeovil.—It was decided by the Yeovil Town Council last week to revise the charges for water supplied by meter within the borough, and to make the rate 2s. 6d. for the first 1000 gallons, and 1s. for each succeeding 1000 gallons used per quarter—the present extra charge for consumption in excess of the average quantity during the summer months to remain in force. It was stated that under the old scale the large consumers paid considerably less for water than the small ones, and that the idea of the alteration now proposed was to make the rate uniform all round. Instead of realizing a profit last year, the sum of £653 had to be drawn from the rates to make the income balance the expenditure.

The Lighting of Tiverton.—A report on the lighting of the town was presented to the Tiverton Town Council yesterday week by Mr. J. Siddalls, the Surveyor. It was suggested that all the lamps be lighted throughout the year, but that about 40 of the 103 full-service lamps and 50 of the short-service lamps be extinguished at 11 o'clock each night. By this means, a saving of about £154 would be effected, but the cost of the extra turning off would be about £50, leaving a net reduction of about £100. The Surveyor and the Gas Manager (Mr. C. Jeffery) had also considered the question of incandescent lighting, and recommended that the whole of the lamps be converted to the incandescent system and fitted with automatic controllers. The cost of the conversion was estimated at £280; and the use of the controllers would save the £50 a year for the turning off of the lamps at 11 o'clock. The saving by the use of controllers would repay the whole cost of the installation in four years. Alderman Thorne thought that it would be a mistake to extinguish every alternate lamp at 11 o'clock, and that difficulties might arise with the police in watching business premises. The Council, however, adopted the report.

SOME **LONDON**

Supplied

Richmond's Gas-



Single Column.

GOVERNMENT BUILDINGS.
Victoria and Albert Museum, South Kensington.
H.M. Office of Works.
H.M. War Office.
H.M. Horse Guards.
H.M. India Office.
H.M. Naval Department, Greenwich.

THEATRES.
Covent Garden Theatre.
Shaftesbury Theatre, Shaftesbury Avenue.

CHURCHES, CHAPELS, ETC.

Baptist Church, Ashwin Street, Dalston	14	supplied.
New Jerusalem Church, Palace Gardens Terrace, Kensington	11	,,
St. George's Church, Aubrey Walk, Kensington	11	,,
Roman Catholic Church, Homerton	8	,,
Percy Road Chapel, Kilburn	6	,,
Baptist Church, Westbourne Grove	7	,,
Chapel, High Street, Stoke Newington	3	,,
Synagogue, Wellington Road, Stoke Newington	3	,,
Christ Church, Harlesden	2	,,
Presbyterian Church, Harlesden	2	,,

Baptist Chapel, Wordsworth Road, Stoke Newington.
St. James' Church, Paddington.
Synagogue, Kensington Palace Road.
Presbyterian Church, Upper George Street, Bryanston Square.

ADVERTISEMENT OF THE RICHMOND GAS STOVE AND METER CO., LTD.

Proposed Gas and Water Works Purchase at Flint.—The Flint Town Council, at their last meeting, discussed a motion: "That the question of the purchase of the Gas and Water Company be considered; and that a Sub-Committee be appointed to go into the matter." One member suggested the addition of the words "and the erecting of an electric light plant;" and in this form the resolution was carried. A Sub-Committee were thereafter appointed to deal with the subject.

Water Question at Maryport.—A meeting held by the Maryport Urban District Council recently, in order to consider the new water scheme, ended in a *fiasco*. The Council had decided to double the main from the River Derwent at Cockermouth, at an estimated cost of £20,000. The decision caused considerable opposition among the ratepayers, who asserted that the scheme was being "rushed." This attitude led some of the councillors to modify their views; and the previous meeting of the Council broke up without the minutes of the Parliamentary Committee being confirmed. At the adjourned meeting, in view of a notice of motion to abandon the scheme, one by Mr. Maughan to confirm the minutes of the Committee found no seconder.

A Possible Paris Gas Strike.—The Paris correspondent of the "Daily Telegraph" says that the men at the Gennevilliers Gas-Works are on strike; and there is some dread that the movement may extend to Paris, owing to the usual appeal to "solidarity." Experts in these matters are not, however, inclined to share this apprehension, or to fear that the "*Ville Lumière*," which, on a memorable occasion, was hereft of its electric light, will be thrown into partial darkness by all the gas employees ceasing work. It is thought that, even if such an extreme course was proposed, the great majority of the men would turn a deaf ear to it. But, as may be remarked, this is simply a matter of opinion. No one took the threatened electric strike seriously until it became an accomplished fact; and history has a way of repeating itself which is not always pleasant.

Exmouth Water Supply.—In consequence of the serious depletion of the quantity of water in the reservoir, to which reference was made in the "JOURNAL" last week, the Exmouth Town Council have been using the fire-engine to pump water from the Yettington Brook. The owner of the mill which is worked by this stream is said to have threatened to apply for an injunction, and it is probable that legal proceedings of some kind will follow. But the District Council appear to have had practically no choice in the matter. The water in the reservoir had sunk to a level below the outlet to the filter-beds; and though the supply was restricted to seven or eight hours a day, it could only be maintained at all by supplementing the ordinary means of supply by drawing upon some other source. The supply from Yettington Brook saved the town from an absolute water famine. According to the town authorities, there is plenty of water there for their requirements, and for the use of the mill. The quantity abstracted by the Council has been limited by the capacity of the fire-engine and of another engine which is used to lift the water to the level from which it can flow into the filter beds.

Public Lighting of Waltham Cross.—At the meeting of the Waltham Cross Urban District Council last week, a tender was received from the Gas Company for the lighting of the public lamps; the prices being £4 15s. 6d. for ordinary lamps and £9 15s. per annum for Lucas lamps, or 5s. more than last year in each instance. In an accompanying letter, it was explained that the higher prices were due to the increased cost of coal. At the same time, it was stated that, if the Council would enter into a contract for five years, and would give their consent to the Company applying to the Board of Trade for the adoption of the "Metropolitan" argand No. 2 burner for testing purposes, in place of the present No. 1 argand, the Directors would instal automatic lighting apparatus; and the saving thereby effected would allow the Company to carry out the contract at the old price. The matter was referred to the Committee.

Lewes Gas Company.—The report for the half year to June 30, which was adopted at the ordinary general meeting of the Lewes Gas Company, stated that the revenue account showed a profit for the six months of £1524. After providing for interest on mortgages, the balance of net revenue, as shown in the profit and loss account, was £2893. The Directors recommended the declaration of dividends for the half year at the rate of 5 per cent. upon the original capital stock and at the rate of 3½ per cent. upon the additional capital stock. The Chairman (Mr. C. R. Kemp) referred to the satisfactory character of the report, and pointed out that Mr. E. A. Jones had been appointed Assistant Manager at the works. He said he had been in the service of the Company for many years, and was a capable and efficient man, so that the Directors thought it was very desirable to appoint him to the office. The Directors and the staff were heartily thanked for their services; and the Chairman, the Secretary (Mr. H. J. Hillman), and the Manager (Mr. Levi Monk) returned thanks.

Sheffield Gas Company's Reserve Fund.—The City Councils' Nominee Directors on the Board of the Sheffield United Gaslight Company have prepared a report in which they state that, though the Company's reserve fund stands at the maximum amount allowed by the Gas Acts, there is carried forward a further sum on revenue account of £98,234, making a balance, with the reserve fund, of no less than £185,182, or £11,086 more than double the statutory reserve. They refer also to the fact that after the recent Corporation Bill had passed the Lords, a petition was presented against it in the Commons by the Company. The petition was sealed with the seal of the Company; and yet the Nominee Directors were absolutely unaware of the intention of the Company to present the petition. They were never informed thereof, nor were the Board consulted. After the presentation of the petition, the Board were at their next meeting informed by the Secretary of the action that had been taken; and such action was approved, after a protest from one of the Nominee Directors. The Nominee Directors are of opinion that such action is contrary to the intention of the Company's Act, and that any such proceeding as the affixing of the seal to important documents should be submitted to the Board before any action is taken.

BUILDINGS

with

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Holy Trinity Schools, Islington	3	,,
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St. Saviour's School, Paddington.		
St. Saviour's Institute, Hogarth Place, Kensington.		
St. Matthias Institute, Kensington	2	,,
Town Hall, Finchley, N.W.	14	,,
Victoria Memorial Hall, Kensington	3	,,
Mission Hall, Church Row, Fulham	3	,,
People's Hall, Goodson Road, Willesden.		
Salvation Army Hall, Flash Walk, Hampstead	2	,,
Orphan Working Home, Hampstead	10	,,

HOTELS, CLUBS, ETC.

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Bath Club, Ltd., 34, Dover Street.
"Butcher's Arms," York Road, Holloway.
"The Enterprise," 35, Walton Street, Chelsea.

COMMERCIAL HOUSES, SHOPS, OFFICES, ETC.

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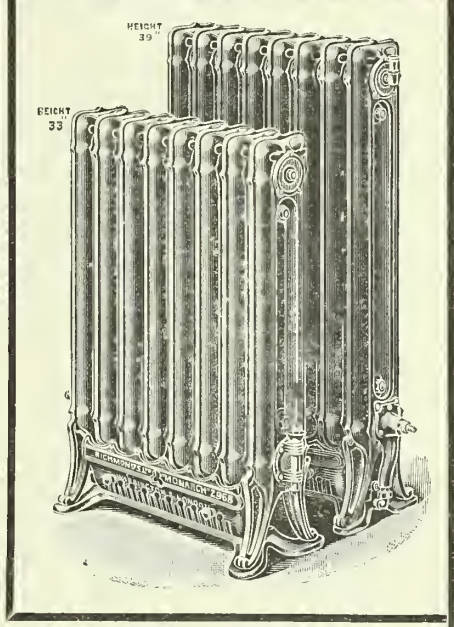
Waring and Gillow, 70-78, Oxford Street	36	,,
Co-operative Printing Society, Tudor Street	20	,,
Waring and Gillow, 110, High Street, Marylebone	14	,,
Cundell, Eve & Co., 10-14, Underwood Place, City Road	6	,,



Double Column.

London Offices and Showrooms: 132, QUEEN VICTORIA STREET, E.C. *General Offices and Works:* WARRINGTON, ETC.

R. Laidlaw and Son (Edinburgh), Limited.—This is the title of a joint-stock Company just registered in Edinburgh, with a capital of £50,000 in £10 shares, to purchase from R. Laidlaw and Son, Limited, of Glasgow, the Edinburgh branch of their business (carried on at Simon Square, Edinburgh), and carry on the business of gas and water meter manufacturers, brassfounders, &c. The first Directors are T. K. Laidlaw, W. K. Laidlaw, and A. Young.

Messrs. James M'Kelvie and Company, colliery proprietors and coal merchants, removed their Edinburgh offices yesterday from the Haymarket to No. 17, Rutland Square.

The Seaford Gas Company, Limited, have placed an order with Messrs. Robert Dempster and Sons, Limited, of Elland, for a new retort-bench, on Waddell's system, complete with all retort mountings, and Scott and Dempster's patent travelling platform over the subway. The work has to be carried out under the supervision of the Company's Manager, Mr. L. D. Mosley.

The electric lights all went out during the performance of the play with which the Cheltenham Theatre was recently re-opened for the autumn season. Fortunately, the performers were resourceful, and kept the audience amused; while the band helped to save the situation by lighting gas-jets in the orchestra, and the big gas sunlight in the roof was turned up. So the performance went on until the electric light was resumed.

The Harrogate Corporation having approached the Local Government Board with a view of securing a longer period than 35 years for the repayment of their water-works loan, a reply has been received from the President, the Right Hon. John Burns, stating that he does not see any reason for extending the period. A member of the Council, on this announcement being made, remarked that it was time all corporations combined to influence Parliament to alter the law.

A joint-stock Company, entitled "Howelite Limited," has just been registered (with a capital of £14,650, in 14,000 ordinary shares of £1 each and 13,000 deferred shares of 1s. each) to acquire the patents and rights for the United Kingdom and Europe in respect of an invention relating to incandescent burners; to adopt an agreement with F. B. Mills; and to carry on the business of manufacturers of and dealers in incandescent gas-fittings and accessories, &c.

The results of the Staveley Coal and Iron Company's working for the past twelve months show that the net profit, after providing for the dividend on the preference shares and the interest on the debentures, amounts to £167,651. The balance of profit brought forward from last year was £28,287, making a total of £195,939. In February, an interim dividend of £5 per share on the "A" and "C" shares and 16s. 8d. per share on the "B" and "D" shares was paid. The Directors now recommend a final dividend for the year of £7 10s. per share on the "A" and "C" shares and £1 5s. per share on the "B" and "D" shares, which will leave a balance of £33,022.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

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FOREMAN OF PURIFICATION DEPARTMENT. Croydon Gas Company.
STOKER. Denbigh Gas and Coke Company.

Gas Literature Wanted.
L. P. LOWE, 1214, Polk Street, San Francisco.

Situations Wanted.
ENGAGEMENT IN GAS OR WATER OFFICE. J. F. Watson, Soham, Cambs.
GAS-FITTER, METER READER, &c. S. Wait, Swindon.
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SITUATION IN GAS-WORKS. No. 4836.

Plant, &c., for Sale.
FOUR CAST-IRON PURIFIERS, &c. Waterside Mills, Hadfield.

Plant, &c., Wanted.
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TELESCOPIC GASHOLDER. Midland Coal, Coke, and Iron Company, Limited, Newcastle, Staffs.
THREE PURIFIERS (SECOND-HAND). W. Metcalf, Limited, Church, Lancs.

Patents for Sale.
RELATING TO GAS-BURNERS.

Company Meeting.
BRITISH GASLIGHT COMPANY, LIMITED. Offices. Sept. 25. 12 o'clock.

Stocks and Shares.
GREAT YARMOUTH GAS COMPANY. Sept. 26.

TENDERS FOR

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BELFAST GAS DEPARTMENT. Tenders by Oct. 3.

Coke.
WANDSWORTH AND PUTNEY GAS COMPANY. Tenders by Sept. 23.

Meters.
GLASGOW GAS DEPARTMENT. Tenders by Sept. 24.

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BIRKENHEAD CORPORATION. Tenders by Sept. 19.
SALFORD GAS DEPARTMENT. Tenders by Sept. 26.

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BLACKPOOL GAS DEPARTMENT. Tenders by Sept. 21.
COLWYN BAY AND COLWYN GAS DEPARTMENT. Tenders by Sept. 24.
ISLE OF THANET GASLIGHT COMPANY. Tenders by Sept. 19.
MARKET HARBOROUGH GAS DEPARTMENT. Tenders by Sept. 21.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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Inasmuch as the present Season's Construction is now let, it seems opportune to state that, excluding American work,

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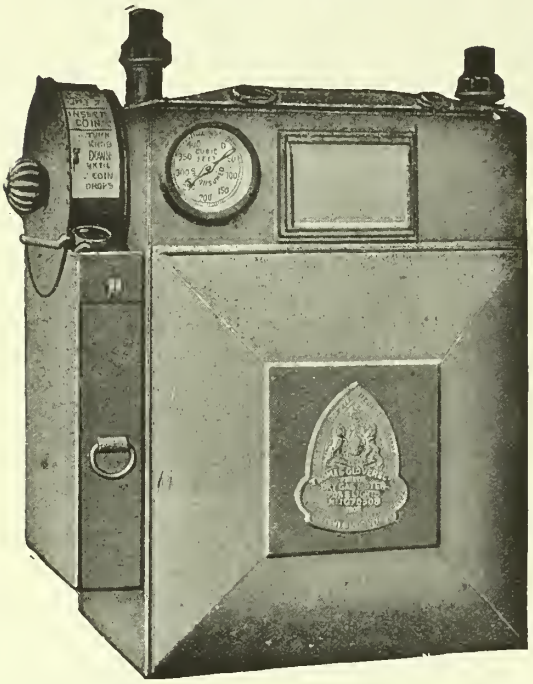

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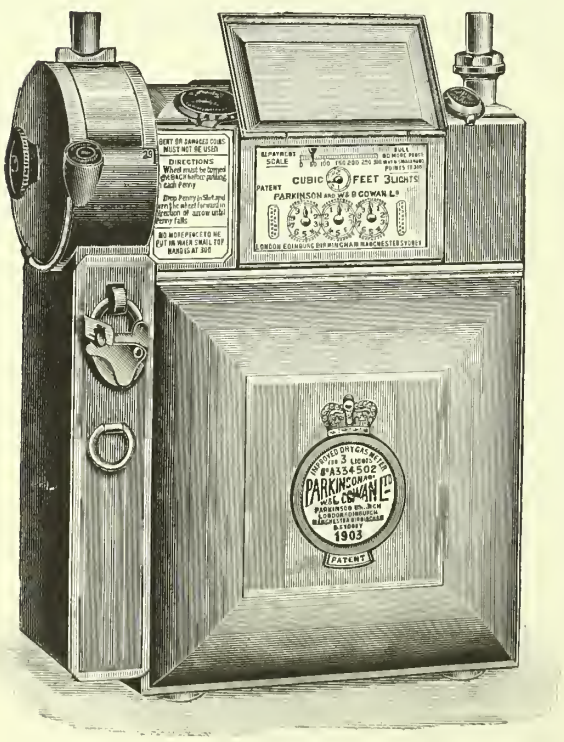

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EDITORIAL NOTES—GAS, &c.

Railway Troubles and Coal Supply.

For the time being, an all-absorbing question for those upon whom hang the burdens of management in industry is not the price of coal, but the probability of a strike of railway labour, and its effect upon the conveyance of coal and other raw material and manufactured goods. Numerous gas-works are dependent not only for the delivery of the whole of their raw material by rail, but for the disposal of their secondary products under contract. The prospect of a railway strike in winter is indeed a serious one for them; and we can recall no time in which the gravity could have been aggravated to the extent that it would be in the coming winter through a chain of circumstances of which home users of coal are the victims, to the profit of coal owners. That chain of circumstances has brought a demand for British coal the like of which, in volume of business, has never been experienced before; and, even with the railways in a state of normal activity, we hear complaint of congestion of goods traffic and of ports blocked. What would be the condition in winter, with a demand for coal multiplied many times compared with the summer, with what traffic that would be possible disorganized through foul weather, with unprecedented export contracts in hand, and with a railway strike pending, it is impossible to say; but it is sufficient to make the manager of a big industrial establishment dependent on a continuity of traffic, tremble to contemplate. We are not taking a despondent view of the future, but are merely cogitating over what may possibly be. And it must be conceded that he is a wise general who, by the omens permitted him, looks to the worst possible contingency, and provides for it to the utmost of his power, though, in truth—regarding the gas manager as the general—present pressure at the collieries and between them and works imposes irritating limitations to that power. Happy are those gas managers with capacious and well-filled stores, and with regular present deliveries. But all are not so fortunate.

Assuming the worst will happen, there is breathing time. We are yet, it is hoped, several weeks from the greatest severity of the winter months; and it is still an open question whether or not there will be a railway strike. If there is to be one, if wise counsels do not prevail, November is mentioned as the earliest (giving time for a ballot of the men) that it could take place. Therefore, in an industry dependent upon railway borne coal for its almost sole raw material, and with the heaviest demand for its produce approaching, the position is such as to call, between now and November, for the straining of every nerve to get into stock as much coal as possible, though in the event the preparation may, fortunately, be shown to have been wasted effort. It will not do to be lulled by any prophetic utterances as to a railway strike being impossible into a feeling of false security, for such prophecies at the present are as worthless as the ill-forebodings of the darkest pessimist. We have not the slightest suspicion that the threat of a strike, if the Amalgamated Society of Railway Servants cannot have the full measure of compliance with their demands by peaceful coercion, has not been made with all earnestness by the leaders. With the justice or otherwise of their demands, we are not immediately concerned; our only theme here being the likelihood or otherwise of a strike. Incidentally, however, there may be an expression of sympathy with the Directors of the large railway systems who desire to manage their own affairs, and settle disputes directly with their employees, without the intervention of any Union. The workers on any railway system, preferring any desire or having any grievance which they believe require remedying, are of themselves, if there is unity of feeling in the matter, strong enough to present a cogent case for consideration by the Board of Directors, and, what is more, compel its consideration.

This brings us to an important point in the considerations affecting the prospects of the culmination of the menaced strike. According to published statistics, the members of the Amalgamated Society form a minority of the workers on the railways. There are, so the figures plainly state, about 580,000 railway employees, of which number 220,000 are eligible for membership. But the latest published returns only credit the Union with a membership of 93,000. The membership therefore only accounts for a small percentage of the men engaged on the individual railways. Apparently there is supreme contempt on the part of the Amalgamated Society for the views of the non-unionists, and for those of the Associated Society of Locomotive Engineers and Firemen; while, by the force of numbers, it should be the non-unionists who should, if there be cause for grievance, initiate movement in the matter, and dictate to the unionists the lines of activity in securing redress. The leaders of the Amalgamated Society aver that the non-unionists are joining their ranks at the rate of 1000 men a week, but it will at that rate take a great many weeks to capture the eligibles for membership, to say nothing of the 360,000 ineligibles. It will therefore rest entirely upon the action of the non-unionists whether or not any effective stand could be made in the event of a strike. Perhaps an equally important factor in the situation is that the Associated Society of Locomotive Engineers, with a roll of 19,000 members (mostly engine drivers), have a programme of their own, and will not support that of the Amalgamated Society by going out on strike. Then regarding finances. The Amalgamated Society are not in such an opulent condition that they could continue a strike for any lengthened period; but they could do so, by depleting their reserves, for a sufficient period to partially disorganize the affairs and disturb the comfort of the whole country. At the end of last year, the accumulated funds of the Society only amounted to £362,732; and the then number of members was 70,130—the *per capita* average of the funds therefore being £5 3s. 5d. That average sum would not go far in a strike. Under such circumstances, the leaders of the Amalgamated Society are sufficiently alert to know that the onus of extreme measures must be thrown on the members generally. The ballot that is to be taken is a momentous one for the leaders who have to the present shown so much persistence and intrepidity. There will, however, be time for excitement to cool, and for loss of heart on the part of many members, before the ballot-papers (which it was announced would be distributed at the beginning of this week) have to be returned—the men not being insensible to the ulterior risk of loss of employment and pension. A railway strike would do an immense injury to the country; but the men know that, from their individual standpoint, their own loss might be irreparable. Taking all these matters into consideration—though it is a dark avenue down which we are looking, and the end of which is unknown—there are the conditions which give hope that the worst will not betide. But it is the possible worst that every management will, in their prudence, contemplate at the present time.

While the labour position on the railways is the most portentous matter for consideration, it does not escape notice that the Railway Companies themselves have not been oblivious just lately to the fact that they are in a position to command little pickings (which in the aggregate mean something enormous) out of the coal situation. There is great dissatisfaction among the coal dealers over the decision of the Companies to charge in future on the net 20 cwt. basis—that is to say, with no allowance for wastage. But there is a prospect that the Board of Trade will intervene, and hold a conference, in regard to this matter. Additional income has also been derived by the Companies from increased siding rent payments; and a new set of regulations, affecting the owners of private waggons, also came into force on Aug. 1, with benefit attached for the Railway Companies. Now, the Companies have given notice that they will increase the rates by ½d. and 1d. per ton (according to ports) for carriage

of coal, coke, breeze, and patent fuel "for shipment," which term, we understand, covers all coal and the other mentioned materials not carried by rail to their ultimate place of use or sale. The charges for waggon-hire on coal, coke, breeze, and patent fuel for shipment for distances exceeding 50 miles are also to be increased from 7d. to 8d. per ton. These additions, small as they appear separately, and "at per ton," all tend to increased costs, to be extracted from the pockets of the unfortunate consumer of the coal and of the produce of its utilization in industry.

"Coalite" Breaks Silence.

When confidence is on the wane, it is not an easy task to rehabilitate it. The confidence of many of those who have taken shares in the speculative enterprise known as the British Coalite Company, Limited, has, since they signed and despatched their application forms in June, been declining; and it was the duty of the Chairman of the Company (Mr. A. G. Kitching), at the statutory meeting on Friday, to attempt the task of restoration. His attempt was a brave one, considering the molecular character of the solid matter he had to present to his expectant audience. Truly, however, some of the shareholders were easily persuaded into sinking the burden of doubt which had oppressed them up to the time of the meeting; but others were not to be deluded by mere rhetoric and apparently a blissful ignorance on the part of the Board of what the Company actually possess in the way of exclusive privileges and rights. Perhaps in commercial, as in other matters, "where ignorance "is bliss, 'tis folly to be wise," but that does not square with our own views.

Let us examine the point as to what are the Company's exclusive privileges and rights. A considerable part of the Chairman's address was taken up with a defence upon the question of the validity of the Company's patents. As to precisely what these patents are only a modicum of information has been allowed to escape; for "acting on the advice of "eminent Counsel," the Company—as we have charged them with doing—"have deferred the publication of the specifica-"tions of the patents to the latest date allowed by the Patent "Office for that purpose." The point of interest about the deferment of publication is withheld, and that is the reason that induced "eminent Counsel"—whose knowledge of coal carbonization in general and of the Company's system in particular cannot be of an order that has in any way contributed to the eminence he has attained—to so advise the Directors of the Company. But if we have not the specifications of the patents, we have the "Coalite;" and that helps the man expert in carbonization to very fairly assay the value of the process. Now what is it the Company hold patents for? Is it for the system of producing the so-called "Coalite," or for the "Coalite" itself as a manufactured article? There is a marked and important distinction here so far as the Company are concerned; and it is on this point that the Board are either ignorant or, having the knowledge, do not care to confess to it before the shareholders. An ingenious person might, "after years of arduous labour" make "the great discovery" of a new way of boiling an egg, which would be "good subject-matter" for a patent in Great Britain, in Germany, in America, or elsewhere, and in regard to which the Patent Office Examiner—competent as that gentleman may be to distinguish differences or likenesses in process—might fail to find any anticipation. But the resulting cooked egg might not be any better than an egg cooked in the old familiar way. And the same with "Coalite." However successful Mr. Parker's system may be, however valid his patents may be for a method incorporating novel details, there are other systems, the growths from a process started a hundred years and more since, by which the same result in the way of a smokeless fuel can be achieved. Therefore it should be made clear to the shareholders that it is not the product itself that is the subject of the patent, but only one of several systems capable of yielding a similar product. We do not at present suggest that any copying of Mr. Parker's particular plant might not lay a person under the obligation of defending himself in an action for infringement; and, so far as we know, as the publication of the specifications of the patents have been withheld "on the advice of eminent Counsel," the Company might be able to uphold their patents. But, from the multitude of carbonizing systems extant, who can tell that the Law Courts might not ignore that "official Patent Office "Examiner" in whom such glorious trust is reposed by the "Coalite" Board, and come to the conclusion that Mr. Parker's invention had been covered by predecessors. As we say, that is an open question; the product of the system is quite another matter.

The Chairman made some flippant remarks about other smokeless fuel that has come on to the market, and produced under other systems of carbonization which do not infringe Mr. Parker's plant. Mr. Kitching's flippancy tickled some of the shareholders; but in after thought they may inquire of themselves whether flippancy constitutes any good proof. He spoke of certain gas companies having made attempts to produce "imitations" of "Coalite;" and he asserted that the most cursory examination showed that they had utterly failed to manufacture a smokeless fuel. With Mr. Kitching we are at variance in this, and challenge him to demonstrate that the Gaslight and Coke Company's "Carbo" (which he endeavoured to ridicule in a somewhat senseless fashion) is not equally as smokeless as "Coalite." He also spoke of coke containing 1 per cent. of volatile matter; and of "Coalite" (this being its virtuous characteristic) containing 12 to 13 per cent. But Mr. Kitching did not inform his audience—perhaps he was not aware of it—that there is no difficulty whatever in gas companies by their present plant, if there is a demand that will pay them to do so, dealing with their coal so as to leave in the spent charge an equal percentage of volatile matter. The proofs that have been afforded by the gas industry of the very modest privileges and rights possessed by the "Coalite" Company, were referred to by the Chairman as "imitations." If the Company hold patent rights for the product as distinct from the system, then the shareholders of the Company should demand, and demand at once, that the Directors should proceed against these imitators. The Directors, or rather their advisers, know better than to make fools of themselves.

It is a mistake—genuine or otherwise—on the part of the "Coalite" Directors to assume that gas undertakings fear their competition. They do not fear the competition; but those who are not sleepy are going to give the Company no quarter, nor will those who are wise give them any facilities for the profitable disposal of their gas, in order that they may be the better able to compete with them with their other produce. Let us emphasize this—*that it is just in those centres where a gas undertaking gives the Company facilities for disposing of their gas, where the conditions will be the most favourable for the Company entering into the keenest competition with their other products, and so with their benefactors.* We can well appreciate the strong desire that the Company entertain at this stage to hold friendly relations with the gas industry; the fear it is evident is on their side that the gas industry will not encourage their advances. The profitable disposal of the unpurified gas produced in making Coalite is the key to the Company's situation. If they cannot dispose of it, their competition in other directions cannot be conducted with the same effect. The Chairman referred, with some elation, to the fact that the Board are negotiating now with an important Gas Company for the supply of 500,000 cubic feet of gas a day; but he declined to say which Company this was, though it was expected the negotiations would be completed in the next few days. It does not say much for the Coalite Company—perhaps the Gas Company in question will note this—that, after all the several months' efforts that they have been making, they have not got any nearer than this with their negotiations with gas undertakings. Only one Company biting, and that Company not yet hooked! The only lands so far, according to the Chairman's speech, that the Company have acquired for works are at Barking and Wednesfield; if it were only at one of these two places that negotiations are pending with Gas Companies, one might make a shrewd guess at the name of the Company concerned in the announcement. But, after all, what do 500,000 cubic feet of gas represent? The non-technical shareholders applauded the goodly roundness of the figure; but if their dividends are to depend on such figures as this, those dividends will not be bloated ones. In the manufacture of "Coalite" about 5000 cubic feet of gas are produced per ton of coal; so that 100 tons of coal a day would yield this 500,000 cubic feet, and the same 100 tons of coal would probably represent a production of only something like 70 tons of "Coalite." And the income of the Coalite Company from the 500,000 cubic feet of gas, if supplied in the crude form, would merely be somewhere—what shall we say?—between £15 and £20 a day. Wherefore then this noise at a meeting of shareholders in a Company with three-quarters of a million of capital, over this expected modest

contract? However, we know that the Directors of the Company are straining every nerve to enter into contracts at one or more places other than Barking and Wednesfield. But most gas companies working under special statutory powers, subject to statutory obligations, will hesitate long—apart from the considerations already advanced—to take up the subservient position of distributors to a Company without any special statutory obligations and under no statutory control, and whose output of gas will be regulated by the demand for "Coalite." It is a serious position; and any gas company taking gas on such terms, without any control over the "Coalite" Company's operations, will be incurring a grave responsibility, and will always have to hold themselves in readiness with plant to make up whatever deficiency there may be in the Company's supply of gas. There is too much speculation and uncertainty about the whole business yet; and we should be sorry indeed to see any gas company ultimate sufferers through what may appear on the surface to-day to be a tempting offer—that is to say, tempting if the competition in products other than gas is kept out of sight.

One other matter, upon which there may be an expression of satisfaction is that this extremely speculative undertaking only secured half the capital for which the Directors asked the public. The confidence of the public in the Company is not to be measured by the fact that the Company consists of 3500 shareholders; for there is no information yet as to the extent of their holdings. But there is an item, in the statement presented at the statutory meeting, of £45,000 for underwriting and commission, and £803 for brokerage. The underwriters are reported to have been hard hit; and there seems to be justification for the report. However that may be, in the public interest three-quarters of a million of money is better than the one-and-a-half millions sought for, with which the Board could speculate to ascertain whether "Coalite" is likely to be a veritable gold mine for the investors in it. A unit of plant is to be started at Barking in November. What the unit will consist of has not been made known; but it will be observed that it is to start after people have filled their cellars with coal "at lowest summer prices." To secure a share in the coming winter's business, the "Coalite" Directors had better try to contract at once with a number of gas undertakings in the Kingdom to carbonize a quantity of coal for them at low temperatures and short-period charges. The hope was expressed by the Chairman that every shareholder present at the meeting would, twelve months hence, be very glad he or she had invested money in "Coalite." We shall see.

The Franco-British Exhibition.

The moving spirits in the matter of a Gas Section for the Franco-British Exhibition are beginning their work in the wrong place. The question of the formation of a Committee is in hand; but we venture to think the first step should have been to ascertain the views on the matter of the Councils of the Institution of Gas Engineers and of the Society of British Gas Industries. If we are not mistaken, the very existence of these two bodies has been ignored. Let us suggest with all sincerity that, before asking gentlemen to join a Committee to essay the task of organizing a Gas Section for Imre Karalfy's exhibition at Shepherd's Bush, the plummet should be dropped, and the depths of success or otherwise be sounded; for no gentleman connected with the gas industry can desire his name to be publicly associated with an Exhibition Committee who might—we do not say would—have a failure to record. In the electrical industry, the good offices of the Institution of Electrical Engineers were invoked at the very outset of the movement for the organization of an engineering section at the Exhibition. Why it has not been so in the case of the gas profession's chief organization, together with the Society of British Gas Industries, we are at a loss to understand. It must be said, however, that though the Institution of Electrical Engineers promised to do what they could, the idea seems to be falling very flat indeed in the electrical manufacturing world.

There are several considerations which should be thoroughly weighed before the scheme for a Gas Section is further prosecuted; but here we will only mention three. In the first place, it is absolutely useless to be a unit in a heterogeneous exhibition of the sort that will be held at Shepherd's Bush, the primary object of which exhibition is not the advancement of industry, but the enrichment of the promoters. Good and lavish entertainment will no doubt be found there. That is what people will go to the exhibition for; and, going there for that purpose, they will not be particularly thankful though never had such a collection of gas appliances and plant been made before. In the second place, the manufacturers will not regard it as a good speculation to spend money for space in such a show; and for space which will have to be occupied by goods and attendants for several months. In the third place, these frequently recurring demands on the gas plant and appliance makers will be to the industry's disadvantage in future. The day will come when we must have another special Gas Exhibition on a scale equal to—perhaps larger than—the one at Earl's Court. The Earl's Court Exhibition did more good for the gas industry than would do any mixing of the industry with the crowd at Shepherd's Bush. We need not labour the matter; but this may be added—the fortnight that has elapsed since reference was last made to the subject has hardened our confidence that from the manufacturers the proposal will receive a cool welcome, and without the manufacturers, we ask in all friendly spirit, what is the good of a Committee?

The Position of Elective Auditors.

From time to time the usefulness or otherwise of elective auditors has been a subject productive of much argument in different quarters; but whatever may be the conclusion arrived at on this point, it must be admitted that the reports of these gentlemen have frequently had a most enlivening effect on the municipal affairs of the towns concerned. Sometimes they have had reference to deputation expenses and to the cost of official outings; while at others matters connected with the public work of the town have been questioned. At the present moment, Widnes is the scene of an elective auditor controversy, which has been brought into being by a discussion in the Town Council on the question of fees; the accounts sent in by the two Auditors amounting to thirty guineas—twenty guineas for one, and ten guineas for the other. The Mayor, who remarked that he had been requested to bring the matter to the notice of the members, stated that since 1901 the fees had gone up from sixteen guineas to thirty guineas, for what was not an audit. "It was," he said, "a matter of poking into expenditure, and bringing up to the public gaze any nice tit-bits." The Committee had nothing to hide; but they thought the charges, which worked out at two guineas a day, were excessive. Subsequently, the gentleman who sent in the account for twenty guineas allowed himself to be interviewed by the representative of a local paper, to whom he explained that ten days was none too much in which to complete his audit, and that the Public Health Act of 1875, section 246, directed the payment to each elective auditor of a reasonable remuneration—such remuneration not being less than two guineas per day for every day in which they were employed in auditing the accounts of a council as an urban sanitary authority. He contended the duties of a professional auditor were totally different from those of an elective auditor. A council might pass accounts which were illegal; and it was not the business of the professional auditor to question the payment, or to criticize expenditure, or to point out any unauthorized, illegal, or wasteful outlay of money. That he regards it as the duty of an elective auditor to question (if he thinks necessary) business transactions of the Council whose accounts he is appointed to investigate, he has proved by communicating with the Local Government Board regarding an overdraft which he is of opinion has turned out to be a very unfortunate affair for the ratepayers.

District Council Finances.

The accounts of the 818 urban district councils which are noticed this week present many similar features to those of the 324 boroughs (outside the Metropolis) which were dealt with in last Tuesday's issue. But, of course, the figures are on a smaller scale. The total amount of loans outstanding at the end of the year 1904-5, for instance, in the case of the district councils amounted to £33,651,601, as compared with £232,244,589 for the borough councils; and whereas in the latter case water-works provided by far the largest individual item, this honour belongs, in the district council accounts, to sewerage and sewage disposal works—responsible for 24·8 per cent. of the outstanding debt. Water-works come next with 16 per cent.; and then follow gas-works

with 10·3 per cent.; while electric lighting figures at 6·2 per cent. The "reproductive" undertakings and works of private improvement in the aggregate represent no less than £13,441,133, or 39·9 per cent., of the total debt. Of course, as with boroughs, education figures largely in the urban district council accounts; the outstanding loans under this head (£3,359,315) being, as a matter of fact, practically the same as those for gas-works (£3,478,011). In all calculations, therefore, the education charges must be borne in mind. But putting these aside altogether, the outstanding loans of the district councils have increased during the four years 1900-1 to 1904-5 by no less than 31·9 per cent.—from £23,064,280 to £30,417,648. The branches of municipal enterprise which have been most largely responsible for this increase are electric lighting and tramways and light railways; the figures for electric lighting having gone up from £758,422 to £2,088,441. From the point of view of the councils, the financial aspect of affairs would appear to be satisfactory; for in the four years named the receipts (excluding education and loans) have increased by 26 per cent., and the expenditure by 25 per cent. So far as the average rate in the pound raised by rates (other than for purposes of education) is concerned, there does not in this time seem to have been very much fluctuation; the figure having ranged between 3s. 3·25d. in 1904-5 and 3s. 1·9d. in 1900-1 on the total assessable value for these purposes. But a different aspect is placed on the matter when it is noticed that during 1904-5 a sum was raised by the councils, by means of rates, for elementary education, representing 1s. 1·5d. in the pound calculated on the assessable value for poor rate of the districts in which the amount was raised. The Blue-Book shows that in the four years mentioned there has been an increase of 62·5 per cent. in the receipts from the most important "reproductive" undertakings (gas-works, water-works, electric lighting, tramways and light railways, and markets), accompanied, of course, by a considerable growth in expenditure.

The Withdrawal of Tenders.

A matter which is of some importance to local authorities generally has lately been agitating the members of the Hythe Town Council, who have been put to some delay in the execution of work they require done by the refusal of a firm to carry out a contract after their tender had been accepted. The contract in question was for the laying of some water-mains; and when the draft was sent to the successful tenderers some time ago, a considerable amount of correspondence ensued between them and the Town Clerk, the upshot of which was that the firm declined to take the contract. The question then arose as to whether the Council had any remedy against the firm for the expense to which they had been put; and to this the Town Clerk replied that he did not think it was any use to try and enforce the contract to begin with. He suggested an application to the next lowest tenderers, and said that if they were not willing to execute the work at the price named, it would be a question whether the Council would not have a remedy against the first firm. He pointed out that the form of tender they signed was one in which they undertook to execute the contract. In answer to a question, he said this form was not stamped; and he added that he very much doubted whether he could advise the Council to bring an action. One member thought that the Council had been very badly treated, for the firm had declined the contract after two months' delay, and had lost £240 to the ratepayers. He therefore proposed that a strong letter should be sent to them, stating that the Council would take steps to place the contract elsewhere, and would consider whether they had not some remedy. He said he should be prepared to support a proposal that the matter should be laid before Counsel for the purpose of obtaining an opinion as to whether something could not be done; for he thought it quite time, after the trouble they had been put to, that they should show the contractors that they could not play "fast and loose" with local bodies. It was agreed that a letter in the form suggested should be sent to the firm; the Mayor, who seconded the resolution, remarking that the facts of the matter had been staring the firm in the face ever since they signed the tender. If it is the case that all the conditions of the contract were made perfectly clear at the time the tenders were asked, it certainly seems natural that the Council should feel somewhat aggrieved at the delay which has taken place. Meanwhile, it has been decided, as a way out of the difficulty, to accept the next lowest tender.

THE NEW DEPARTMENT AT LEEDS UNIVERSITY.

The Stipend of the Professor of Fuel.

It is to be feared the letter from Sir George Livesey and the editorial reference to it ("Journal" for Sept. 10), respecting his proposal that the gas industry should show its interest in the new branch of work at the Leeds University by providing annually the stipend attaching to the Professorship of Fuel was published at an inopportune time—that is to say, during the holiday season, and during a period when Board and Committee meetings have been postponed. But now Boards and Committees will be re-assembling and resuming their work; and we ask that the matter may be brought to their notice. Full information may be obtained by referring to pp. 677, 681 of our issue for Sept. 10. The total annual sum required is only £500; and towards this the following promises of contribution have been received.

ANNUAL SUBSCRIPTIONS PROMISED.

Leeds Corporation Gas Committee . . .	£100 0 0
Gaslight and Coke Company	100 0 0
South Metropolitan Gas Company . . .	100 0 0
South Suburban Gas Company.	20 0 0
Mr. John Holliday (East Hull Gas Company) .	3 3 0
	£323 3 0

It will be seen from these figures that the promise of an annual sum of less than £200 is all that is required now.

The Institute of Sanitary Engineers held their opening sessional meeting on Monday of last week at the Holborn Restaurant, when the President (Mr. Baldwin Latham) held a reception, and subsequently delivered an address on the importance of the study of subjects associated with sanitary engineering. A matter which he strongly recommended for careful investigation was the question of lead poisoning in relation to the water supply of towns.

A Melbourne Appointment.—Mr. P. C. Holmes Hunt's many friends on this side will be pleased to hear that his year as Acting Engineer of the Metropolitan Gas Company of Melbourne having expired, the Board have appointed him Engineer to the Company. The appointment, it may be mentioned, was accompanied by a very gratifying expression of the Board's appreciation of the zeal, earnestness, and enthusiasm he had thrown into the work. It will be remembered that Mr. Hunt was appointed Assistant-Engineer to the Company in 1902; and last year he was raised to the position of Acting-Engineer, with a view to the confirmation later on which has now been made.

Book-Keeping Down to Date.—The rapidity with which we receive succeeding editions of this small but useful book, by Mr. Andrew Munro, F.C.I.S., is the best possible testimony to the favour which has been accorded to it. The work (which has already found its way into numerous gas offices) has reached its fourth edition; and it is only a little more than twelve months since the issue of the third edition had to be recorded. In view of what has on previous occasions been said of the book in the pages of the "Journal," it is only necessary now to say that it has been revised and enlarged, and is published by Mr. Effingham Wilson, at the price of 2s. 6d. net.

North of England Gas Managers' Association.—The sixty-first half-yearly general meeting of the Association will take place at the George Hotel, Harrogate, on Saturday, the 5th prox., under the presidency of Mr. H. Wilkinson, who will deliver his Inaugural Address. There will also be a paper by Mr. J. C. Angus, of York, on the "Comparative Development of Gas and Electricity as Illuminants." Should the weather permit, a drive on a motor char-a-banc is projected, and a visit to the light railway of the Harrogate Gas Company, the cutting of the first sod in connection with which, by Mr. F. Barber, the Chairman, was recorded in the "Journal" for May 14 (p. 473). Subsequently, by invitation of the Chairman and Directors of the Gas Company, the members will lunch at the George Hotel.

Leeds University and Gas Heating Research.—It will doubtless be remembered that, when referring in the "Journal" for July 16 (p. 152) to the subject of gas engineering at the Leeds University, it was stated that arrangements were under consideration whereby the Institution of Gas Engineers would be able to carry out a scheme of technical research work in connection with the University, under the direction of a Joint Research Committee, consisting of representatives both of the industry and the University staff. Attention is called to the matter here, for the purpose of mentioning an advertisement in to-day's issue, stating that an experienced Research Chemist is required at the University, to undertake an investigation on the economic and hygienic aspects of heating by coal gas, under the direction of a Joint Committee representing the Institution of Gas Engineers and the University. Applications will be received up to the 3rd prox.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 849.)

Business on the Stock Exchange last week, as in a good many previous weeks, chopped and changed and had its ups and downs. But, unlike its immediate predecessor, which began with a spurt and ended very tired, this time got over its sickness in the earlier half and finished up much better. Of course, animation throughout was much subdued, and things in general were on a holiday scale. The opening was very dull. Consols were steady at first, but afterwards drooped in view of gold going abroad. Home Rails continued a prey to bears, aided by perfervid utterances of the less informed Press, and letters from parliamentarians who had perforce to keep an eye on the Labour vote. Tuesday's tone was rather weaker and much more sensitive, though one or two lines were steadied by special circumstances. Wednesday was almost lifeless; the situation being intensified by a Jewish holiday. Thursday showed no well marked mood beyond being generally listless. There was, however, some demand for Consols, which put them up $\frac{1}{8}$. Friday took a line of its own; and instead of the usual realizations on that day, the tone was brighter and firmer. Some good investment buying put Consols up; and even Home Rails were a bit better on bear closing. The improvement was fairly maintained on Saturday; and Consols closed $\frac{1}{4}$ higher. The Money Market exhibited extreme ease; the supply being superabundant to meet all demands. Discount rates were rather hard at first, consequent on gold movements; but they relaxed later on. Business in the Gas Market was a shade more active than the previous week; and the tone was equally firm—all the few changes in quotation being for the better. In Gaslight and Coke issues, the ordinary was very quiet until quite the end of the week. Prices were rather better and very close—ranging only within the limits of 94-94$\frac{3}{4}$. Not much was done in secured issues. The maximum changed hands at 87 and 87$\frac{1}{2}$; the preference at 105$\frac{1}{2}$ and 106 (a rise of 1 in the quotation); and the debenture at 82 and 82$\frac{3}{4}$. South Metropolitan was more dealt in; but prices were scarcely so good as the week before, varying from 119$\frac{1}{4}$ to 120$\frac{1}{2}$. Commercials were quiet at 102$\frac{1}{4}$ and 102$\frac{3}{4}$ for the 4 per cent., 99 for the 3$\frac{1}{2}$ per cent., and 81 and 81$\frac{1}{2}$ for the debenture. In the Suburban and Provincial group, Bournemouth "A" was done at 28$\frac{1}{4}$, ditto "B" at 17 (a fractional rise in each), Brighton original at 223, Bromley "B" at 88$\frac{1}{2}$ and 89, South Suburban at 115, ditto preference at 117$\frac{1}{2}$ free, Tottenham "B" at 102$\frac{1}{4}$, and West Ham at 102. The Continental Companies were quiet. Imperial marked from 174$\frac{1}{2}$ to 176, Union 112, European fully-paid 22$\frac{5}{8}$, and Tuscan 10$\frac{11}{16}$. Among the undertakings of the remoter world, Buenos Ayres was done at 10$\frac{15}{16}$, ditto debenture at 93$\frac{1}{2}$, Cape Town debenture at 95$\frac{1}{2}$, Primitiva at 6$\frac{15}{16}$, ditto preference at 5$\frac{1}{32}$, ditto debenture at 94$\frac{3}{8}$, and River Plate at 13$\frac{3}{8}$ and 13$\frac{3}{16}$.

ELECTRIC LIGHTING MEMORANDA.

Electric Wiring Risks—Need for Greater Supervision and Inspection—Property, Life, and Shock Risks—American Fires and their Lessons—Statistics on Tour, and the Result.

In referring to a suggestion last week by an electrical contemporary, that it would be a good thing if Mr. Lloyd-George would next session turn his attention to bringing up to date the general legislation affecting electricity supply, we expressed the hope that the President of the Board of Trade, if he devoted time and mind to this useful object, would do something towards eliminating the inequality of the law as between gas and electricity supply, and protecting the electricity consumer, by instituting penalty testing for electricity supply, and compulsory testing and stamping of electricity meters. If he takes the matter up, perhaps beforehand he will also read an article on "Electric Wiring Risks," by Mr. Frank Broadbent, M.Inst.E.E., which has been published in the "Electrical Review," consider it in conjunction with the *magnum opus* of the Institution of Electrical Engineers, comprising the mighty array of rules which are necessary in electric wiring and installation work, together with the efforts of the Home Office and certain fire offices in the same direction, and see whether it would not be advisable in the public interest for all this provision for protection to have compulsory supervision and inspection attached to it. Mr. Broadbent is very emphatic upon the point as to "the need for careful supervision and inspection of electrical work" being "more than ever necessary." And he asserts that "it is doubtful if the technical staffs, either of the Home Office or Insurance Companies, are sufficient to give that amount of inspection which is necessary." Again, later on, he remarks: "Nowadays the use of electricity and flexible cords is so general as to have become a commonplace, so that there is more need than formerly to make electrical apparatus as safe as possible, both as regards fire risk and risk to life." But it is certain there will not be that careful supervision and inspection—not only of first installations but extensions—that Mr. Broadbent says is so necessary till there is compulsion. In America, the tendency is in the direction of appointing an electrical inspector by the city authorities; and yet in towns where this practice is adopted "electrical fires and dangerous shocks are not unknown." However, this question of supervision and inspection is another point for Mr. Lloyd-George to look into.

It would appear in reading Mr. Broadbent's article that in America more attention is paid to the protection of property than to the safeguarding of life. But opinion there is inclining to the view that this is not as things should be, and that there should be greater protection not only against the risk to human life from fire, but against shock, which may possibly prove fatal. In the form of lamp socket used in America for electric incandescent lamps, there is danger; for a person touching it may receive "a severe and possibly a fatal shock." In this country, the bayonet holder is almost universally used; and the danger of receiving anything like a fatal shock from this is very remote indeed. But still there are on the market, as Mr. Broadbent mentions, patterns of key-holders from which nasty shocks can be obtained; and it is wise, as is done in the rules of the Institution of Electrical Engineers, to prohibit their use on circuits carrying pressures greater than 250 volts. This point as to voltage reminds that in the United States 110 volt parallel systems, or three-wire systems with 220 volts across the outers, are still quite common; but a voltage of 200 to 250 is looked upon as a daugerous one. It was shown in the "Memoranda" quite recently that there had been in this country several instances of death caused by electricity supplied at this common voltage. Mr. Broadbent considers that electrical work carried out by firms of standing offers very small risk, from the fire hazard point of view. But we would point out that the firms of standing are generally the firms who charge most for their work; and that a very large proportion of installation work finds its way into the hands of firms who cut prices and are expert at scamping. Among them lies the greater danger, and the reason for the greater need for compulsory supervision and inspection. It is freely admitted by Mr. Broadbent that the increasing use of motors on systems carrying pressures of 400 volts and over makes it more than ever requisite that every precaution should be taken to prevent shocks being sustained by people——many of whom are unskilled—who have the handling of electrical apparatus.

An interesting part of Mr. Broadbent's article is a digest of a report by the Electrical Bureau of the National Board of Underwriters. From the report covering the electrical fires from Jan. 10 to April 19, it appears that 141 fires were due either to defective installations or to careless handling of electrical apparatus. Of these, 21 fires were caused by high-tension lines falling on telephone and lighting circuits. In this country, fires have also been known to be caused—though Mr. Broadbent says the cases are rare—by trolley wires falling across, and making contact with, telephone wires. Lately, in this country, the question of overhead wiring, on account of cheapness of installation, has been revived; but simultaneously, in Canada and the United States, the danger arising from the use of overhead wires in cities is causing considerable concern. According to the "Montreal Star," the Underwriters' Association believe that some of the recent disastrous fires in the city have been due to the general use of overhead wires; and they have called upon the city authorities to construct underground conduits as soon as possible, so that all wires may be buried. Regarding other causes of electrical fires. In the three months, 18 of the fires were produced by the grounding of lighting and motor circuits; and short-circuits on interior installations occasioned 32 fires. Fires caused by electric flat-irons and movable picture machines are not separated; the total being nine. "One of the risks of electric flat-irons is that they overheat when not in use. But in some works, the stands are provided with switches which automatically cut off the current from the iron when it is laid down." One of the largest fires reported—resulting in the loss of £250,000—was due to carelessness in the use of an electric flat-iron. It is explained that the lighting company for some reason shut off the current from the building, and later in the day turned it on again. In the meantime, a maid had attempted to use an electric flat-iron, and finding the current off left the iron, switched on, lying on inflammable material. It would be impossible, says Mr. Broadbent, to prevent such an accident as this, except by providing the circuits with no-voltage release switches. However, the risk is big for such an insignificant service as is rendered by an electric flat-iron.

But to proceed. Fuses blowing caused six fires, electric motors and rheostats caused between them 13 fires, electric incandescent and arc lamps five fires, and electric bed-warmers two fires. One case is that of an old lady who used an electric bed-warmer, which she was supposed to turn off when it became hot; but as she was too feeble to reach the socket, the warmer set fire to the bed. Another fire (which caused a loss of £6000) was due to a motor-starter being left in the starting position, instead of being thrown over to the running position. In the concluding part of his article, the much debated question of the use of flexible cords is treated by Mr. Broadbent; the attack upon them evidently being prompted by a case in which a long flexible cord of a pendant lamp was twisted round a steam-pipe, which resulted in a short-circuit, and set fire to the insulation and to other goods in the neighbourhood. Mr. Broadbent regards these flexible wires as the "most risky part of any installation put up according to approved methods." It is indeed "as risky to use unprotected flexible wires for electrical apparatus, more particularly for portable apparatus, as to use rubber pipe for portable gas apparatus." Condemned by all fire offices, the time will, he thinks, probably come when unprotected flexible cord for portable apparatus will

also be prohibited. Still, after all is said, our electrical competitors continue to plead with householders for their custom on the ground that there never was anything safer introduced into a house than electric lighting and heating. Never has there been anything introduced more insidious in its action, nor anything more capable of hiding the destructive side of its character. Fortunately, in this, it has not always succeeded.

While upon the subject of electrical accidents, an interesting instance of the circuitous course sometimes taken by news is afforded by a paragraph published in the "Electrician" less than a fortnight since. It was headed "Accidents Caused in Germany by Various Systems of Lighting." It commences with: "L'Industrie Electrique gives some interesting statistics of the accidents caused by various illuminants during 1906 in Germany." The figures published were first contributed by Herr Schäfer to the "Journal für Gasbeleuchtung," were published by us and commented upon on July 16 last (pp. 148, 182), have been published by "L'Industrie Electrique," and have now returned to England, and found a place in the "Electrician." The circular tour taken by these figures has not improved matters. In our electrical contemporary, the first column is headed "Nature of Accidents;" and the figures are arranged against the words "slight," "serious," "fatal." Now if the column had been headed "Number of," and the figures set against the words "Accidents," "Men injured," "Men killed" (see *ante* p. 182), the figures would have had a different and correct value. It is well to have data of this kind published accurately—particularly when we read, "the following table only takes into account accidents which happened to people." Published in the form given by the "Electrician" we have 302 accidents by gas which caused human sacrifice and distress, and 123 by electricity; whereas as a matter of fact there were only 112 accidents by gas and 42 by electricity. In the 112 gas accidents 149 men were injured, 41 fatally. In the 42 electrical accidents, 46 men were injured, 35 fatally. Although the accidents caused by gas were more numerous owing to the considerably greater use of gas than electricity, there were only 41 fatalities compared with 35 in the case of electricity with its much smaller use.

It was only in last week's "Memoranda" that reference was made, and this was not the first time, to the folly of committing places of public assembly, such as churches, to a system of lighting that has become notorious for its want of reliability, and more especially without making provision for an alternative system of illumination. A great responsibility rests upon those who put such trust in electric current for lighting that they adopt it solely for the illumination of churches and other public buildings. We are adjured not to put our trust in princes; but certainly some of the modern ones appear to be more worthy of confidence than the electric light. The admonition therefore appears to require a little qualification and extension to make it apply to the modern conditions of life. On the occasion of the harvest thanksgiving service at the Old Windsor Parish Church one night last week, the electric light collapsed, and the sacred edifice was plunged in total darkness. Report states that the words of the Psalmist, "Thou makest darkness and it is night," were being chanted. We cannot vouch for the truth of the statement. But if true the words were appropriate to the incident. Fortunately there was no panic; and the choir manfully stuck to duty. The spectacle of the Church begging for candles from neighbours was witnessed; and under difficulties the service was continued.

AN INDICTMENT OF MUNICIPAL TRADING.

We publish in another column an abstract of the remarkable report which Mr. Hubert Leicester, Chartered Accountant, has presented to the Barnstaple Corporation on the financial position of their electricity undertaking after some five years' working. Frequent reference has been made in the "Journal" to the difficulties by which the Corporation have been beset in the conduct of this business, and the lessons they seem to offer to other local authorities who may be tempted to engage in similar speculations in the hope of serving the interests of their constituents, the ratepayers. The fact which has been most conspicuous in the carrying on of this business is that, while the ratepayers have been mulcted in ever-increasing charges for the lighting of the streets, the electricity undertaking has failed to make a profit, and, on the contrary, has shown from its inception a steadily increasing adverse balance. This is a condition of things not confined to Barnstaple. Mr. Leicester's report is, however, a complete vindication of the critics of the administration of the town, who have insisted again and again that municipal trading as carried on there is much more likely to lead to bankruptcy than to affluence.

Although the report refers particularly to the Barnstaple accounts, and deals especially with the state of things existing in that town, its principles have a far wider application. Mr. Leicester speaks with authority in such matters. As he himself says, his conclusions are "the result of much consideration and experience." He has been Mayor of Worcester—a position in which he could not fail to appreciate the troubles of a municipality saddled with the burden of an unremunerative electricity undertaking. But his interest in such matters dates back much longer than his selection for high municipal office. Many years ago Mr. Leicester published a remarkable paper, in which he pointed out that the policy of borrowing money for all sorts of municipal purposes is attended with grave risks, and that, so far as it aims at "placing the burden on posterity," it is a fallacy, because the present generation of ratepayers is punished equally with those who are to follow it. Mr. Leicester has not succeeded in inducing local authorities (not even the important one over which he recently presided as Mayor) to adopt his views on cash payment—principally, no doubt, for the reason that everyone of them is burdened with debt, and it is easier to add to debt than to even temporarily increase the current rates for the sake of avoiding payment of interest in future. This, however, is rather beside the mark. It only shows that, when he refers to such subjects as the proper division between capital and revenue expenditure and the depreciation of the assets of a municipality, Mr. Leicester does not speak as a novice, but as one well versed, in such matters as these.

The two things which stand out most conspicuously in the revelation he has made to the Barnstaple Corporation are the little revenue which the electricity works have succeeded in earning, apart from what is received indirectly from the rates for public lighting, and the absence of any provision for depreciation. Familiar as we are with the manner in which the revenue of municipal electricity works is assisted, it is a little startling to find that of the total sum of £13,445 that the Barnstaple electric undertaking has received from the sale of current in the five years of its history, no less than £6330, or 47 per cent., has been derived from public lighting. It is now easy to understand the constantly reiterated complaints about the cost of public lighting at Barnstaple. With the burden of an undertaking which has cost £31,165, and a population which has shown no anxiety to pay extravagantly for its private lighting in order to meet the heavy charges for interest and sinking fund, the Corporation have been driven to make a revenue of a sort by charging a good round sum for public lighting. It is a common device. There are few, if any, municipalities owning electricity works which do not make the rates contribute in this manner to the support of the undertaking. Sometimes they are able divide the burden with a tramway business; but in one way or another, whether electricity works are "profitable" or not, the ratepayers are liberal, though probably unconscious, contributors to their support. An interesting little sidelight on the value of ordinary accounts as a true criterion of municipal trading is afforded in an observation of Mr. Leicester with reference to certain stock on hand in connection with the public lamps. This is rightly taken into the account as an asset, and if used upon public lighting without making any further charge against the Corporation, it will enable the department to show a small profit on this branch of its business. Mr. Leicester, however, foresees that "there is the danger that when this stock is used in repair and maintenance of public lamps it may again be charged to the Corporation," to the consequent increase of the "profit."

With regard to depreciation, Mr. Leicester's figures do not differ materially from those of other people who have given attention to the subject, and certainly do not err on the side of an excessive allowance. In proposing to write off 10 per cent. for machinery, he practically assumes that everything about the undertaking is to be worn out, and that nothing will be scrapped for obsolescence. This is a moderate estimate, and taken in connection with other items, such as 2 per cent. for buildings and 4 per cent. for mains, no electrical engineer can say that it is more than prudence would suggest. But in this matter there is a great gulf fixed between theory and practice—between what is desirable and what is actually done. In Barnstaple, the sum of £2170 ought year by year to be laid by to provide for depreciation on the scale which is necessary if the plant is to be replaced as it is worn out. Instead of this, all that the Corporation are doing is to set aside a sum equal to £676 per annum, with which to repay within the statutory period the debts they have incurred on account of the electricity undertaking. Mr. Leicester says, truly enough, "it is not the custom of many electricity undertakings to make any provision for depreciation other than that required by the Local Government Board." The fact that it is not the custom to follow the right course in this matter is doubtless due to the circumstance that most corporations running electricity works are in the same position as that at Barnstaple, and have no money to spare.

What position they will be in when the day comes for the renewal of worn-out plant, the original cost of which has not been discharged, will depend largely upon the view taken by the Local Government Board. The Board may allow "one asset to represent two loans," which would obviously be a very simple solution of the difficulty from the Corporation's standpoint. On the other hand, the Board may insist—as in the interest of the loanholders it should—on everything in the nature of a replacement being treated as a renewal and charged to revenue. If it should uniformly take this course, there are very unpleasant times in store for the ratepayers, not only of Barnstaple but of many other towns, carrying on trading undertakings on municipal rather than business lines. We shall await with some curiosity the decision of the Barnstaple Town Council upon the recommendations of the Accountant whose verdict they have invited. It may be the Corporation will devise means by which they will be able to pay off the adverse balance on the revenue account of their unfortunate undertaking, and at the same time make that provision for the

future which will avoid the possibility—which Mr. Leicester fears—of "a heavy call upon the rates each year to meet the deficiency resulting from increased interest and instalment of loans." How it is to be done we do not know. No doubt a heavy call upon the rates now would avoid the necessity of a still greater call later; but the Barnstaple Council will have made no slight approach to municipal heroism if they pay off the deficiency which they have allowed to accumulate as the result of their five years' trading and make provision for preventing any further loss by charging such a price for current as will enable the works to pay their way. In the matter of depreciation, we anticipate that the Corporation will be content, if they are allowed, to let things slide as they have done in the past.

LOCAL INCOME AND EXPENDITURE.

Finances of Urban District Councils.

REFERENCE is again made this week to Part V. of the Annual Local Taxation Returns, for the purpose of noticing some of the figures therein contained which relate to the finances of the urban district councils. In our last issue, the portion devoted to the affairs of the councils of boroughs was dealt with; and it was then pointed out (and it is a fact which must be carefully borne in mind) that the statistics furnished by the Blue-Book are for the year 1904-5.

The number of urban district councils in England and Wales, for districts other than boroughs, dealt with in the report is 818. This shows an increase of five as compared with the previous year—nine urban districts having been formed during 1904-5, while four which appeared previously are not included owing to the fact that they were incorporated in 1903-4. It may be mentioned that there will be seven more urban districts to remove from the next Blue-Book—one having been incorporated and six added to boroughs during the year now under review. It is pointed out in the report that the financial transactions of urban district councils resemble in many respects those of the borough councils, although they are generally speaking on a smaller scale. As in the case of town councils, a considerable portion of the transactions recorded relates to gas, electric lighting, water, market, and tramway undertakings, the "reproductive" nature of which, of course, has to be borne in mind in considering the effect of the outlay on taxation. The receipts of the urban district councils (not being borough councils), excluding those from loans, during the year 1904-5 amounted to £10,476,119, including £1,388,852 on account of elementary education. Deducting the latter item, the total was £9,087,267, compared with £8,880,437 in the preceding year. These receipts included sums received from County Councils under the provisions of the Local Government Act, 1888, and also grants under the Agricultural Rates Act, 1896. The latter Act, however, does not apply to general district rates, which, in the case of the urban district councils produced 86 per cent. (£4,986,545) of the total raised by rates (£5,791,613), so that the amount of the grants is small in comparison with that of the total income from rates. Among the other receipts were: Gas-works, £843,024; water-works, £794,092; electric light undertakings, £216,927; and tramways and light railways, £142,413. So far as the compilers of the Blue-Book could ascertain from the returns made, the receipts in respect of gas-works included £628,110 from gas-rentals, and £184,502 from sales of residual products. The receipts in respect of the water-works included £453,025 from water rates, rents, or charges for domestic purposes within the respective districts of the councils owning the water-works. They also included sums of £72,830 and £79,150 received by the Urbau District Councils of Enfield and Tottenham for the transfer of their undertakings to the Metropolitan Water Board. The amount raised during the year 1904-5 by means of public rates accounts for 55 per cent., while the receipts from reproductive undertakings (together with those in respect of private improvement works) represent rather more than 26·5 per cent. of the total receipts.

The total expeuditure of the councils in the twelve months under review (excluding that defrayed out of loans) was £10,361,206. Deducting the outlay on elementary education, the expenditure was £8,969,257, as compared with £8,761,947 in the preceding year (1903-4). The increase was thus £207,310; and it occurred chiefly in connection with the loan charges—principal repaid, interest, and payments to sinking funds and redemption funds—and in items relating to public works. The increase in respect of the loan charges was £74,732. Among the expenditure was £1,720,541 on public roads, &c.; £1,284,875 on education; £568,723 on gas-works; £477,756 on public lighting (including £77,026 for lighting by electricity); £470,654 on sewerage and sewage disposal works; £375,476 on water-works; £131,846 on tramways and light railways; £102,687 on electric lighting (not being public electric lighting); and £2,670,245 on repayment of principal of loans (otherwise than out of sinking funds or redemption funds), payments to sinking funds, and interest on loans. Of the principal and interest so repaid, and allocations to sinking funds, £218,626 was on account of gas-works, £417,302 of water-works, £124,093 of electric lighting, and £63,180 of tramways and light railways. The aggregate length of main roads maintained and repaired by the councils at the commencement of the year 1904-5 was 2405 miles; and the outlay under this head during the year amounted to £483,735, or at the rate of £201 per mile. The total length of the roads other than main roads maintained by the councils was 11,315 miles; the expenditure being £910,105, or an average cost of £80 per mile.

The expenditure out of loans (including certain sums spent in anticipation of loans) during 1904-5 amounted to £3,958,592. Of this, £256,209 was on gas-works, £357,050 on water-works, £513,651 on electric lighting, £608,846 on tramways and light railways, and £646,652 on sewerage and sewage disposal works. The total expenditure out of loans in 1904-5, for purposes other than elementary education, was greater than that of 1903-4 by £81,962. Considerable decreases are shown under the headings of water-works and sewerage and sewage disposal works; but, on the other hand, those of gas-works and tramways and light railways exhibit a large increase. The total amount of the loans raised was £3,929,137, including the following amounts: Gas-works, £276,865; water-works, £346,790; electric lighting, £409,895; tramways and light railways, £658,991; and sewerage and sewage disposal works, £604,025. The amount of loans raised during the year (excluding moneys borrowed for purposes of elementary education) was less than in 1903-4 by £40,023. The loans in respect of electric lighting, water-works, and sewerage and sewage disposal works were much smaller; while considerable increases are shown in the amounts raised for gas-works and tramways and light railways.

The amount actually repaid during the year in respect of loans (including payments out of sinking and redemption funds) was £1,551,064, excluding unexpended balances of loans applied to repayment of principal. The outstanding loans at the end of the year 1904-5 amounted to £33,651,601. Of this debt, £8,338,475, or 24·8 per cent., was incurred for purposes of sewerage and sewage disposal; £5,386,862, or 16 per cent., for water-works; £3,478,011, or 10·3 per cent., for gas-works; £3,359,315, or 10 per cent., for education; £2,747,780, or 8·2 per cent., for street improvements; £2,088,441, or 6·2 per cent., for electric lighting; and £1,369,729, or 4·1 per cent., for tramways and light railways. The loans outstanding in respect of what are termed the "reproductive" undertakings and works of private improvement, represent a large proportion—£13,441,133, or 39·9 per cent.—of the total debt. The total amount of loans outstanding increased during the year ending March 31, 1905, by £1,235,792; the purposes in respect of which the largest increases took place being tramways and light railways, electric lighting, and gas-works. The amount remaining at the end of the year in sinking and redemption funds for meeting loans that are repayable in this way was £508,997. The sum paid to the funds during the year was £185,273; and the amount taken out of the funds and applied to the repayment of principal was £143,807.

According to the census of 1901, aud taking into account the alterations of area since that time, the total population of the 818 urban districts other than boroughs was 7,111,517, including 213,648 in respect of districts which were added to, or became, boroughs during 1904-5. The total assessable value of these districts for the purposes of the general district rates, or other rates out of which the general expenses of the district councils were defrayed, was £31,479,046, including £1,037,562 in respect of the districts which were added to, or became, boroughs during the year. The rates raised by the councils, other than for purposes of elementary education, amounted to £5,148,581, and were equivalent to 3s. 3·25d. in the pound on the total assessable value of the districts for the purposes of such rates. This figure compares with 3s. 2·8d. in 1903-4, 3s. 3·1d. in 1902-3, 3s. 3d. in 1901-2, and 3s. 1·9d. in 1900-1. The total amount raised by means of rates during the year 1904-5 for purposes of elementary education was £643,032—which was equivalent to a rate of 1s. 1·5d. in the pound calculated on the assessable value for poor rate of the districts concerned.

Comparative tables accompanying the returns show that the receipts of urban district councils from all sources except elementary education, but excluding the receipts from loans, increased between 1900-1 and 1904-5 by 26 per cent.; while the total expenditure not defrayed out of loans increased by 25 per cent. The receipts from public rates for purposes other than elementary education (including grants under the Agricultural Rates Act, 1896), which in 1900-1 amounted to £4,307,776 and in 1904-5 to £5,152,791, show an increase of 19·6 per cent. in the four years. The increase between 1903-4 and 1904-5 amounted to £85,197, or 1·7 per cent. Receipts from gas-works, water-works, electric lighting, tramways and light railways, and markets show an increase during the four years of 62·5 per cent.; while the annual expenditure in connection with these undertakings has also grown considerably. The amount of the outstanding loans, for purposes other than elementary education, rose from £23,064,280 at the end of 1900-1 to £30,417,648 at the end of 1904-5—an increase of 31·9 per cent. in the four years. The principal increases in the amounts outstanding in the period named were in respect of loans for electric lighting, tramways and railways, sewerage and sewage disposal works, water-works, gas-works, and street improvements. As regards electric lighting undertakings and tramways and light railways, it is pointed out in the Blue-Book, the increases are specially noticeable; the total amounts of the loans outstanding for these purposes having risen respectively from £758,422 and £160,667 at the end of 1900-1, to £2,088,441 and £1,369,729 at the end of 1904-5.

ENGINEERING AND MACHINERY EXHIBITION.

The Engineering and Machinery Exhibition at Olympia last year was such an unqualified success, that it was determined to hold another this year, of which it was hoped some of the larger engineering firms would avail themselves, to even better demonstrate the progress of British mechanical manufactures during recent years. The determination has been fully justified by the excellent exhibition inaugurated last Thursday by Sir Alex. B. W. Kennedy, LL.D., F.R.S., President of the Institution of Civil Engineers, in the presence of representatives of most of the engineering societies, including one of the Vice-Presidents of the Institution of Gas Engineers (Mr. James W. Helps), the Honorary Secretary (Mr. S. Y. Shoubridge), and the Secretary (Mr. W. T. Dunn). The exhibition this year is on a larger scale than last; but nevertheless, thanks to the energy of the Organizing Managers (Messrs. G. D. Smith and F. W. Bridges), and the hearty co-operation of exhibitors, the great display was well advanced towards completion when the President made his tour of the stands. There was evident gratification on the part of Sir Alexander, who has taken a close personal interest in the preparations, on the completeness and comprehensive character of the display; and his congratulations were of the warmest at the little opening ceremony in the centre of the vast building.

A large part of the exhibition is taken up by machine tools, larger and more varied in character than at the exhibition a year ago. In gas-works, machine tools have acquired an important standing; and their use is ever on the increase. This is one of the results of the daily extending use of mechanically operated plant in such works; and now facilities for promptly attending to breakdowns and doing repair work are of immense importance in the economics of gas-works. Therefore the gas-works engineer finds it more and more essential to keep himself acquainted with all that is modern in the nature of machine and hand tools which may be of service to him. At an exhibition of this kind, he has the latest and the best gathered together for his examination. He will discover on inspection that there have been considerable strides made in the production of all these useful machines, either in new purpose or in greater refinement in the performance of the old. We cannot here enumerate the types of the machines to be seen; but a visit to the exhibition (any time before Oct. 19) will confirm our statement.

It is a very big field that is covered by the exhibition. Attention is also claimed by gas-engines, suction-gas plants, engine indicators, air gas, castings, furnaces, steam pumps and fittings, boilers and their accessories, air-compressors, valves, hand tools, pneumatic tools; and special mention might be made of the Fairbanks Company with their large selection of shop appliances, and of Messrs. Joshua Heap and Co.'s machines for pipe, nut, and bolt work. Casting the eyes along other stands, conveyors are found, scientific instruments for maintaining a strict care over work to ensure economy, gauges, packings and jointings, lubricators, belting, fans and blowers, ventilators, water-meters, and time registers—in fact, there are a thousand-and-one contrivances of interest to the gas engineer and works manager.

Specially referring to certain of the exhibits, Messrs. Crossley Brothers are showing their gas-engines connected up to suction-gas plant; the same with the National Gas-Engine Company, Limited, and Messrs. Richard Hornsby and Sons, Limited. The Fairbanks Company are also showing a 7-horse power gas-engine. Regarding the air-gas systems on view, great claims are, of course, made for them. The Non-Explosive Gas Company (Cox's system) give the information that their gas is composed of 1·4 per cent. of hydrocarbon vapour and 98·6 per cent. of air. A report upon the system has been made by Messrs. C. E. Cassal, F.I.C., and J. Kerr, F.I.C. "As the result of a large number of photometric observations, using an inverted burner, and the small No. 1 mantle recommended," these reporters "have obtained an average illuminating power of 125 standard candles per burner, as against an average illuminating power of 40 standard candles per burner obtained with ordinary gas tested under the same conditions, and with mantles of the same type." The National Air-Gas Company with their apparatus produce a gas composed of 98½ per cent. of air and 1½ per cent. of commercial petrol vapour. The light afforded is stated to be 75 per cent. cheaper than incandescent light with coal gas, but only 93 per cent. cheaper than coal gas used with flat-flame burners. It is obvious that one of these two figures, or both of them, must be wrong. We rather incline to the belief that both are open to question.

Messrs. Alex. Wright and Co. are showing the Simmance-Abady "CO_2 mbustion" recorders, draught gauges, air-meters, fuel feed or fire-feed recorders, calorimeters, pressure-recorders, specific gravity bell, "Flicker" photometer, &c. The Hohmann and Maurer Manufacturing Company are exhibiting thermometers, gauges, hydrometers, improved gas-leakage indicators, &c. Messrs. Sanders, Rehders, and Co. are showing their "Sarco" combustion (CO_2), pressure, and gas-volume recorders, and many other instruments.

Among other exhibitors, we notice the Pulsometer Engineering Company, who are showing the largest and the smallest size of their "Pulsometer" steam-pumps. The small one, which throws 1000 gallons an hour, is only 17 inches high; while the large one, which throws 150,000 gallons, measures 126 inches. An interesting exhibit is that of the Lowca Engineering Company, Limited, who have staged a new and improved method of screening, conveying, and handling all materials by machinery mounted on ball-bearings. Messrs. John Barker and Co., Limited, are forward again with Kennedy's patent machine for bending cold, by hand or power, iron, copper, brass, and steel tubes up to 2 inches. Practical demonstration of the excellent work of this machine is made at the stand. The British Coin-Handling Machine Company are showing their automatic cashiers and silver sorters, which were described not long since in our columns.

A number of lectures have been arranged for during the course of the exhibition; among them being one last Saturday night on "Gas-Engines and Suction-Gas Plant," by Mr. Hal Williams, and next Saturday one on "Sanitation and Ventilation," by Mr. A. E. Battle.

Military music and a café chantant will give each day diversion to the more prosaic duty of inspection of the exhibits.

After the formal opening of the exhibition on Thursday, there was an inaugural luncheon, at which there were a large number of guests. The President was in the chair. Afterwards, there were a few toasts. The one wishing "Success to the Engineering and Machinery Exhibition" was proposed by the Hon. Sir Horace Tozer, Agent-General for Queensland; and response was made by the President. In the course of his remarks, he said he remembered the Great Exhibition of 1851, and most of the exhibitions that had succeeded it. Regarding the present exhibition, representing what it did, it might be considered a large one indeed, and not by any means a small one. There were something like 25 per cent. more exhibitors than last year; and the exhibits he believed weighed between 2500 and 3000 tons, corresponding to an estimated value of something like £100,000. The machinery in motion in the exhibition would, no doubt, have its perennial attraction for the visitors. It covered some of the most modern constructions of electrically-driven tools adapted for special work, and capable of being used at exceptionally high speeds. In fact, if he were to single out any one class of machinery which was particularly well represented in the exhibition, it would be the class of machine tools. The collection was of unusual excellence, embracing, as it did, some fine exhibits not only from the manufacturers of this country, but from the Continent and from America. The Managers of the exhibition last year were able, generously, to hand over £500 to the benevolent funds of the various engineering societies; and they were very handsome and welcome donations. As Chairman of the Benevolent Fund of the Institution of Civil Engineers, he had, therefore, a very personal interest, not only in the technical, but also in the financial success of this exhibition; and he hoped, and, indeed, had no doubt, that this year, as formerly, the success of the exhibition would be sufficiently great to enable the Managers to again help those benevolent funds. The toast of "The Engineering Industries" was proposed by Professor Ewing in a racy speech; and responded to by Mr. T. Hurry Riches, the President of the Institution of Mechanical Engineers.

Lecture on Gas-Engines and Suction-Gas Plants.

The first lecture at the Exhibition was delivered on Saturday evening by Mr. Hal Williams, M.Inst.M.E., Assoc.M.Inst.E.E., on "Gas-Engines and Suction-Gas Plants." Professor Burstall, of Birmingham University, who is well known in connection with the investigations of the Gas Engine Research Committee of the Institution of Mechanical Engineers, was in the chair.

In his opening remarks, the lecturer said that, in addressing an audience composed most largely of engineers, it would not be necessary to attempt to prove the economy of gas-engines and suction-gas plants over other forms of motive power; and therefore they might take it for granted, as already proved over and over again, that suction-gas plants had a heat efficiency of 89 per cent., and that a gas-engine had a heat efficiency in the ordinary way of over 30 per cent. This compared with 72 per cent. in the steam-boiler, and 7 to 10 per cent. in the steam-engine.

Continuing, he referred briefly to two-cycle engines, and went on to deal with the "Otto" cycle horizontal engine, which he stated was, in his opinion, the most satisfactory form of gas-engine yet devised, and the most reliable from the power-user's point of view. Mr. Williams emphasized the necessity of reliability, and pointed out that power is cheap only so far as it is reliable, and that an economical engine with a tendency to stop is a far worse investment than an extravagant engine which keeps the wheels going round. In this connection, he pointed out that, so far as present knowledge of gas-engine design extended, this reliability was to be found in keeping the cylinders of the engines of moderate dimensions, and obtaining increased power by multiplying the number of cylinders rather than by increasing their size. He laid it down that, in his opinion, it was not advisable to have a larger diameter of cylinder than from 21 to 24 inches; the reason being that in large cylinders the expansion produced by the excessive heat of the explosion, which reached 1500° C., introduced difficulties of design which had not yet been satisfactorily overcome. In dealing with governing, Mr. Williams gave preference to engines which were governed by the variable admission of a mixture of constant quality.

The lecturer then proceeded to deal with the cooling of gas-engines, and the temperature at which the water should leave the jackets, and pointed out that it was just as necessary to keep the

water round the jackets as hot as possible in a gas-engine as it was to steam-jacket the cylinders of a steam-engine. He also instanced several methods of re-cooling the jacket-cooling water for use over and over again.

As regards the starting of gas-engines, he advocated the use of compressed air and large receivers. He pointed out that engines up to 150 H.P. could quite easily be started by a starter consisting of a small pump which introduced the first charge of gas and air into the cylinder. He then dealt with various points in connection with the general design of gas-engines, and the materials from which the shaft and connecting-rods should be constructed; stating that, in his opinion, only Siemens-Martin acid steel should be used for these purposes.

In dealing with suction-gas plants, Mr. Williams explained the necessity of designing the plants so that the proper zones were always maintained, and stated that a great deal of the trouble which arose with these plants was due entirely to the ignorance of the operators who were working them, and who had not had explained to them the first principles of gas production.

In conclusion, he referred to Mr. Dugald Clerk's experiments on the specific heat of the products of combustion at high temperatures, and said he felt that the future of the large gas-engine depended on some satisfactory means being obtained of reducing the temperature in the cylinder due to the explosion of the gaseous mixtures.

THE USE OF GAS FOR HEATING PURPOSES.

It will be remembered that in the course of the paper entitled "The True Scope of a Gas-Works," read by Herr Kobbert before the Mannheim meeting of the German Gas Association (see *ante*, p. 96), the speaker expressed the opinion that the proper method to be adopted with the object of converting a gas-works into the true central station for the generation of all the heat required in a neighbourhood was to make a gas of much lower calorific value than is customary at present, and to do everything possible in order to stimulate its consumption in heating stoves and the like. At the close of the paper Dr. Bunte remarked that, having regard to the existing dimensions of distributing systems, and to the class of illuminating burner in use, &c., it was not advisable to diminish the calorific power of gas below some 560 B.Th.U. per cubic foot, and that, therefore, every endeavour should be made to increase the quantity of coke sold for heating purposes. Herr Körting, of Berlin, followed Dr. Bunte on somewhat similar lines; and the gist of his observations may be summarized from the account published in the "Journal für Gasbeleuchtung."

Herr Körting said that it was not desirable to make gas of less calorific intensity than 560 B.Th.U. Such a gas still retained the present characteristic of coal gas of being a high-grade fuel; and yet its manufacture did not involve the retention of the expensive process necessary to confer upon it a high illuminating power when consumed in non-incandescent burners. The question for the future was, therefore, how best such a gas could be made, and what alterations in the manufacturing process were requisite, in view of the fact that machinery was being increasingly used on gas-works, and that the mechanical energy required must come from the consumption of coke either under steam-boilers or in gas producers. The manner in which the manufacture of gas had altered of late was best shown by the following table, where the quantity of gas and of coke made, and the amount of coke consumed for various purposes on the works, were indicated per unit of coal carbonized. On examining the figures, it would be seen that when the retorts were fired direct, the quantity of coke consumed in the furnaces was large, while but little was used for the production of mechanical energy. The introduction of regenerative furnaces greatly reduced the amount of coke consumed. When the conditions of manufacture were so changed that a gas of 560 B.Th.U. was made in retorts with regenerative settings (drawing and charging machines being employed), the retorts had to be raised in temperature and the charges decreased. In this manner less coke was left for sale, because more was consumed. When inclined retorts were adopted, gas of the calorific power mentioned could hardly be produced owing to the high speed with which the gas left the carbonizing vessels, unless the process of auto-carburation was adopted. This, again, in comparison with the ordinary regenerative settings referred to in Column 2 of the table, increased the amount of coke consumed and reduced the quantity available for sale. The final stage of the evolution consisted in the introduction of vertical retorts, which once again, compared with Column 2, involved an increase in the consumption and a decrease in the saleable coke. In fact, through the adoption of improved methods of working, the amount of coke left available for sale had, since the days of horizontal retorts fired with regenerative furnaces, diminished per unit of coal carbonized in the ratio 18 : 13.

Herr Körting went on to say that appliances for warming a whole building by the combustion of coke in one furnace were certainly very beneficial to the gas industry, inasmuch as they enabled gas engineers to compete with brown coal briquettes and cheap coal as providers of heat. Indeed, the coal merchants were looking forward to a day when Berlin would not be able to make as much coke as it used in the production of heat, although the annual consumption of gas there was approximately 4600 cubic feet per head of the population. In spite of the competition of electricity, members of the upper middle class were still the best customers of the gas trade; and they would become even larger consumers when the true advantages of the gas-fire were more generally appreciated. In one of the best residential suburbs of Berlin, the consumption of gas was 12,700 cubic feet per head per annum. In such a suburb the consumption might be increased much further if only proper steps were to be taken to bring to the notice of the residents the great advantages of a gas-fire for warming well furnished rooms. A gas-fire was peculiarly advantageous for employment in a bedroom, where it was specially desirable to be able to raise the temperature sharply in the shortest time possible and to lower it again as rapidly. Even in large buildings, the use of gas-firing was beneficial. For example, the head offices of the Imperial Gas Association in Berlin consisted of two houses containing sixty-eight rooms, in which 137 officials were engaged from 8 a.m. to 4 p.m., while six porters and 48 messengers required accommodation every day for short periods of time. In these offices gas-heating was so much liked that Herr Körting had recently been requested to remove the last of the existing coke-stoves. The total consumption of gas for lighting and heating the whole premises was 2,320,000 cubic feet per annum, worth at the present selling price about £400. This was a sum of money which was too small to be appreciable in the accounts of any large house of business such as a bank; and it would be much better for establishments of the kind to adopt gas-fires than to trouble about systems of heating the whole of their buildings by means of coke consumed in one or more centralized furnaces.

Make and Consumption of Coke Expressed as a Percentage of the Coal Carbonized.

—	1. Direct-Fired Retorts.	2. Regenerative Furnaces.	3. Regenerative Furnaces, High Temp., Mechanically Worked Retorts.	4. Inclined Retorts and Auto-Carburation.	5. Vertical Retorts.
Gas made per long ton, cub. ft.	10,750	10,750	11,500	12,350	12,900
Coke made, per cent.	70	70	70	70	70
Consumption—					
Heating retorts	22	12	14	12	15
For power	2	2	2	2	2
Charging and drawing machinery	—	—	3	—	—
Coal and coke handling plant	—	—	3	3	3
Water gas manufacture	—	—	—	4	—
Steam raising	—	—	—	—	1
Total consumption	24	14	22	21	21
Coke available for sale	46	56	48	49	49

Gas Engines in America.

In the course of an article in the "Times Engineering Supplement" on the "American Gas Engineering Industry," Mr. H. E. Wimperis says that, compared with Europe, the United States has been slow to adopt gas-engine working; but there are now many signs that progress is being made. The most extensive installation of which he is aware is that at San Francisco, where the California Gas and Electric Company have had an enormous plant put down for supplying the necessary mechanical power for the operation of their electric generators. At present it consists of three units of 4000 H.P. each. Another is being erected, and the foundations laid for a fifth. It is intended ultimately to increase the output to 40,000 or 50,000 H.P. Previous to the installation of this plant, the largest which had been put to work were those at the Lackawanna Steel Company, of Buffalo, and the big pumping plant installed at the centre of the natural gas industry in the east. In Germany, Mr. Wimperis remarks, the large gas-engiue has generally been associated with the utilization of waste gases from blast-furnaces; and the extent to which this principle has developed in that country is very great indeed. Possibilities in this direction are governed by the annual output of pig iron, and by the efficiency with which the process is being worked; and the output of pig iron in the United States is more than equal to that of Germany and Great Britain combined. Another source of power which does not appear to have yet been utilized in the United States is that of the waste gases coming from the coke ovens used to produce coke for metallurgical processes. In fact, the waste power available is of enormous amount. After detailing some cases of engines worked by blast-furnace gas, suction producer gas, and natural gas, Mr. Wimperis concludes by stating that practical tests of machine peat as a producer-gas fuel have recently been carried out by the United States Geological Survey. Two kinds of peat were tested—one partly raw and partly machine-treated peat, and the other entirely machine peat. It was found that the raw peat was unsatisfactory in working, as it produced very poor gas. On the other hand, machine peat, procured from Florida, gave very good results, both as regards reliability and calorific power. The general conclusion is that machine-dried peat can be used with success in producer plant, and is, indeed, better fitted for that than for use with steam-boilers. This, he adds, opens a further field for the use of gas-engines; and it will be interesting to see how far advantage is taken of it.

THE STOCKPORT CORPORATION GAS-WORKS.

An Official Inspection.

View on the Drawing-Floor of the Inclined Retort-House.

Opportunely, the Chairman (Mr. Councillor James Fernley) and members of the Stockport Corporation Gas Committee have afforded their colleagues of the Council an occasion for making a special inspection of the gas-works. We say "opportunely" because three parts of the new large inclined retort installation and the coal and coke conveying and storing plants (which have their novel features) are now in daily work; and it is expected that they will be fully employed as the winter progresses. That the members of the Council who are not specially engaged in the administration of this important public service are deeply interested in its working and processes was evinced by the fact that between forty and fifty of their total number of 64—including his Worship the Mayor, Alderman Henry Bell, D.L. of Cheshire—made it convenient to be present at this official inspection last Wednesday. The others were denied the pleasure through business engagement or, regrettably, through illness.

Meeting in the Committee-room, the visitors were very cordially welcomed by Mr. Fernley, who expressed the gratification of himself and his colleagues of the Committee that so many had found it convenient to attend. The large company were then divided into parties; the first being headed by Mr. S. Meunier, the Corporation Gas Engineer, and subsequent ones by the Assistant-Engineer (Mr. G. Hutchinson), the Chief Draughtsman (Mr. Allsop), and other of Mr. Meunier's willing assistants. The Contractors, Messrs. Gibbons Bros., Limited (retort benches and settings, bench ironwork, coal-hoppers, measuring-chambers, and shoots), and Messrs. Robert Dempster and Sons, Limited (coal and coke handling plant), were represented respectively by Mr. J. M'Ewen and Mr. E. J. King. The Lancashire Dynamo Company's Representative (Mr. Mason) was also present.

It is some time since the members of the Corporation have officially visited the works; and they were hugely impressed with the vast changes that have been made in them under Mr. Meunier's scheming; for scheming involving ingenuity and much anxiety there has had to be with circumstances throwing considerable obstacles in the path of the making of a straightforward job in modernizing and extension. Not only did the vast changes impress, but the large advances that have been made in manufacturing process with the view to economical and maximum production also riveted attention. Naturally, the first part of the work visited was the old retort-house, in which, in place of twelve beds (running down the centre of the house) of direct-fired retorts, comprising 66 in all, Mr. Meunier has packed in 192 inclined 15-feet retorts, divided into four benches, four arches to a bench, and twelve retorts (set in four vertical tiers) to a bed. It will be remembered that a full detailed description, with illustrations, of this inclined retort installation and its auxiliary coal and coke handling plant was published in the "Journal" for April 9, 16, and 23; and all the visitors to the gas-works last Wednesday were handed reprints of the articles. In view of that publication in our columns, there is no occasion to again enter into the details of the installation. Readers, however, may be reminded that there are three particularly interesting features about the house. One is that the regenerator parts of the new settings is recessed to give more space on the clinkering-floor; the second that, in view of the tight fit of the benches in the house, and consequently the necessity for making conditions bearable for the men, Mr. Meunier has given the benches an insulation of slagwool between the superficial and inner brickwork; and the third that the old strongly constructed central main flue has been retained. This main flue is situated about 2½ feet below the discharging-floor between the parallel double benches. Now that the settings are at work all down one side of the house and one-fourth of the retorts on the other side, some notion can be gained as to the success or otherwise of Mr. Meunier's provision for the protection of the workers from heat. The day to put that provision to the proof is one when a high atmospheric temperature prevails; for what exists inside the house on such a day is the worst condition in respect of heat that there will be there. Last Wednesday was really sultry; so much so that it was fatiguing walking about the works in the open air. But under such oppressive conditions, the heat in the retort-house it can conscientiously be said was not worse, in fact was more endurable, than in several inclined retort-houses it has been our lot to visit. The method of insulation answers admirably; the radiation from the benches being reduced to a minimum. It cannot, however, be denied that on the discharge floor, the old central main flue causes an upward ascent of heat; but the modification of this is not beyond possibility and the scope of engineering. A structural alteration is in the Engineer's mind, whereby he will ventilate the flue on the exterior with outlets to the open air. A difficulty of this kind, though one peculiar to an individual works, is of general engineering interest.

It will be borne in mind that the retorts are only 15 feet long; and, at the present time, they are being worked with 5 cwt. charges, or 12 tons per bed per day. Therefore the duration of carbonizing is six hours. The visitors watched with interest for some time the discharging of the retorts; and then went on to the upper floor to see the operation of charging. While here they observed the excellent provision that has been made in the shape of outside covered balconies to give passing way for the operatives and place for fresh air when not engaged in charging. Some of the venturesome councillors even went and examined, from the numerous platforms provided for facilitating attention, the coke-conveying and other plant.

The coal and coke plants were working exceedingly well; and considering their novel features, their extent, and so forth, witness must be borne to the fact that, since it started on its work in

April last, it has required the minimum of attention here and there in the way of adjustment.

Neither from the retort-settings nor from the coal and coke plant can any working details be given, because in connection with both it has been a period of training with the men; it being for them quite a revolution in the system of working. Therefore there must be regular operation before proper and dependable figures can be realized.

From a thorough inspection of the new plant, the visitors turned to an examination, and explanation of the purposes, of the other parts of the plant—from the condensers onwards. We will not occupy our readers' attention by going into details; but it may be said in passing that Mr. Meunier is now using, in a Livesey washer, a naphthalene solvent, of a specific gravity of 1·023 at 60° Fahr., from his carburetted water-gas relief holder. This may be more of a tar oil than actually tar. From Mr. Meunier's records, these particulars are taken of the use of Mr. Colson's solvent in the washer between Aug. 19 and Sept. 19, 1906: Number of times solvent changed, 2; gas passed, 16,790,200 cubic feet. Between Aug. 19 and Sept. 19, 1907, the washer was filled with carburetted water-gas tar solvent. Number of times changed, 2; gas passed, 38,764,200 cubic feet. In this case, the maximum efficiency is when the solvent is frothing well, which ceases when the solvent gets saturated with naphthalene, and sinks to the bottom of the washer. In the case of Mr. Colson's solvent, it was floated on the water; but as will be remarked from the specific gravity of the carburetted water gas tar, the method has been altered, and the Livesey washer entirely filled. So long as the contents of the washer can be kept in a frothy condition, no trouble with naphthalene appears, but as soon as the frothing begins to disappear, then a few complaints commence to arise. With regard to the figures quoted here, we do not lay much stress on them, because they are only taken over a month; and to be really valuable, they should be for a longer period, with such additional information as the number of complaints, the temperature, and the state of the weather for the corresponding periods. Mr. Meunier himself suggests that it is quite possible the latter cause alone has been favourable to this year; but off hand, he fancies there have been rather more complaints this year than last, though the number has been very slight.

The visitors were all greatly interested in the machinery house—listening attentively to information given as to the uses of the exhausters. In one part of the house, there are engines and compressors for high-pressure distribution, by which plant gas is sent at a higher pressure than ordinarily through a line of 4-inch steel pipes for the better supply of a district some five miles distant. The engines are of 35 indicated horse-power; and the compressors are of the Ingersoll-Sergeant Drill Company's type. Their maximum capacity is 24,000 cubic feet per hour at 150 revolutions per minute. The compression is to 7½ lbs. in the summer and 12 lbs. during the winter. This leaves a reserve of 3 to 5 lbs. at the inlet of the regulators. One of Bailey's reducing-valves is placed at the outlet of the receiver, and set to give the pressure required on the main. Valves are placed every mile on the main; the first one being ½ mile away. Pressure test-boxes are also fixed every mile. The regulators are of Crawford's pattern—the first regulator reducing from 3 to 5 lbs. to 1 lb.; and the second reducing from 1 lb. to the pressure required in the district. The purifier-houses were next inspected. The old water-lute purifiers were seen; and then the four large boxes, with eight lids to each box, on Green's system, each box holding about 90 tons of oxide. An interesting feature of this house is the means of conveyance for the oxide. There are overhead rails on which runs a small electrically worked carriage supporting an iron skip and a seat for the operator. The purpose of this is to lift the revivified oxide from the floor below, and to convey it to the purifier being filled. The experimental gas-making plant, the chemical laboratory, and the workshops were all viewed. In the last-named, the machine tools were busily employed; for in a works the size of those at Stockport there must ever be repairing work in hand, and this must increase with the extension of mechanical operation, and call for the greater employment of good craftsmen. In the workshops, in addition to parts of heavy plant, meters and lanterns were also seen under repair, and repaired meters under test.

Subsequently the members of the Town Council and others were entertained to tea at the Warren Bulkeley Hotel, where Councillor FERNLEY, the Chairman of the Gas Committee, presided.

The CHAIRMAN, after the loyal toasts, stated that while a member of the Gas Committee he had taken great interest in the work of the retort equipment as far as a layman could do; and he was sure that the ratepayers' money in the undertaking was well invested. He then called upon Mr. Meunier to give an explanation of the work done.

Mr. MEUNIER explained the new plant at considerable length, and, adding to the description which has already appeared in the "JOURNAL,"* said that the plant which had been done away with was built somewhere in the seventies. He had never been able to find out the exact year; but he thought it was in 1874. It was of the ordinary horizontal type of retorts, with direct firing. The plant was getting worn out, and the question cropped up as to what should be done to replace it. After a good deal of consideration, the Committee decided to go in for inclined retorts. The difficulties were very great. The house was only 64 feet in width; and it was necessary that there should be two settings installed. An experimental setting was put in during 1903 and 1904, at a cost of £1250. The setting worked continuously for twelve months; and the only time when any difficulty was found with it was in the hot weather in September, when it was necessary to open the ventilators which had previously been purposely closed. This turned out so successfully that the Committee decided to extend the process, with the result that they had seen that day. The next question was how to handle the coal and coke; and it was this which engaged the attention of a Sub-Committee for some time. They went round a number of works and inspected the systems which had been put in by various firms, and ultimately it was decided to place the order in the hands of Messrs. Robert Dempster and Sons, Limited, of Elland. The Committee were so pleased with the working of the one at Shrewsbury, that they thought it would suit their purpose much better than any other. The cost of the retort-settings was £17,500, and the conveying plant £8443. There was nothing very special with regard to the coal elevating and conveying plant—that was in pretty general use in various parts of the country; but the coke conveying and elevating plant was somewhat new. It was thought it would be an improvement to have an additional elevator, so that as long as there was room it should be a continuous process without any manual labour, and that the ordinary storage bunkers should be only used when the others were full or in case of necessity. The Local Government Board inquiry was held in May, 1906. The total amount asked for was £25,000; and the Board granted £21,826. The difference of £3172 was considered by the Board to be the value of the old plant, and this had to be paid out of the reserve fund. The work was commenced in May, 1906, and the first section was brought into operation in April, 1907. The coal-breaker was equal to a capacity of 30 tons per hour, and the twin elevators were each capable of lifting 30 tons per hour. The capacity of the coke-conveying plant was 15 to 20 tons per hour. Each storage bunker held 14 tons of coal, which was equivalent to a 24 hours' supply. With regard to the question of driving, it was originally intended to use gas-engines, which was the usual plant in gas-works; but the Chairman of the Electricity Committee had a communication with the Chairman of the Gas Committee, with the result that it was decided to have electric motors, each of 12 H.P. The motors had an advantage in saving a lot of shafting. The capacity of the crane skip was one ton; and it could be filled and emptied again very comfortably in two minutes. The coke was not only stored for sale, but thoroughly screened; so that they got nothing but big coke in the two large bunkers, nothing but dust in the second bunker, and small coke in the other one. As a matter of fact, they could load a cart with 25 to 27 cwt. of coke inside a minute. The Committee were now doing what they could to develop a ready sale for the whole of these sizes. With reference to the capacity of the retorts, there were twelve to each bed, and four beds to the section, each 15 feet long; and they charged them with 5 cwt. of coal at a time. The coke-storage bunkers held 60 tons, so that they had a very fair capacity. With their present six-hour charges, they were carbonizing 12 tons 12 cwt. per bed per twenty-four hours, or more than one ton for each retort. If they went on four-hour charges, they could do from 14 to 15 tons. It was anticipated that there would be great economy in the use of this system, which was by no means a new one, but which was a new adaptation of something which had been in vogue for fifteen years. The use of retort-house governors was new, and they were found to be a distinct advantage—there was less watchfulness necessary in the engine-house. The governors should pay for themselves in the first twelve months.

Councillor BREWSTER submitted the toast of "The Contractors." He said the work had been going on for some time, but they had had many obstructions in the way of old buildings and old plant to contend with. They had put retorts in a house of such a width as had never been attempted before; but he felt confident the Contractors would justify what had been done. They thought they had adopted a system which was practically the last word in gas engineering. The plant had a substantial appearance about it, and everything seemed to indicate that it would do all that the Contractors claimed for it. The comparative statistics issued at the close of every year showed that at Stockport they obtained far above the average percentage of gas per ton of coal, they sold 94 per cent. of the gas produced, and paid more wages per ton of coal than a large number of gas undertakings in the country.

Mr. KING, who represented Messrs. Robert Dempster and Sons, replied. He said that their Managing-Director (Mr. Broadhead), who had had charge of the work, was unavoidably absent. He was glad to see that the Corporation were pleased with the work which the Contractors had done. He did not think there was any retort-house in the country which made so much gas, on the space occupied, as was done at Stockport. It was very much to their Engineer's credit that he had installed a work of this description. Mr. Meunier was the master hand, and the Contractors had worked under his instructions. They undoubtedly expressed Mr. Meunier's opinions in carrying out the work; and he ventured to hope they had been successful. It might be said that machinery would displace labour; but he thought it was much more advantageous to develop a man upon higher scientific lines than to always have him wheeling barrows filled with coal. By the introduction of this machinery, they got a higher class of mechanic than was in vogue; and what was lost in one direction was gained in another. It was a development in the right direction. He hoped the scheme would turn out to be a financial success, and a credit alike to the Corporation and to Mr. Meunier.

Alderman G. LEIGH, in moving a vote of thanks to the Gas Committee for the invitation to visit the plant, said the machinery appeared to him to be the very height of ingenuity and it worked with great precision. He believed that the results would justify the expenditure.

Mr. FAIRHURST, in seconding the resolution, said though they might have displaced labour by the new installation, they were satisfied that it was the best system to adopt. The work of the men had previously been most trying.

The vote of thanks was supported by Messrs. Skuse, Thomas, Stockton, and Widdowson, and heartily carried.

Mr. FERNLEY, in responding, said that in Mr. Meunier they had a Gas Engineer second to none in the country. The undertaking since he took it in hand had been very satisfactory indeed, and as a commercial enterprise it would pay large dividends. If it was a private concern, many of them would like to be shareholders.

* See "JOURNAL," Vol. XCVIII., pp. 87, 150, 218.

GAS-WORKS IMPROVEMENTS AT STIRLING—INSTALLATION OF STOKING MACHINERY.

At Stirling last Tuesday, the inauguration ceremony took place in connection with various improvements that have been effected at the gas-works there, including the introduction of an installation of charging and discharging machinery, of which the following interesting account has been supplied.

In order to cope efficiently with the ever-increasing demand for gas at Stirling, an addition to the carbonizing plant has been found to be very necessary; and as the existing retort-house was already filled with two benches of sixes—one each side of a chimney, one bench consisting of four settings of sixes, the other eight settings of sixes, built on the shallow regenerator type—the question arose as to the best methods of altering or extending, so as to get the maximum results with the minimum of expenditure. After much careful consideration, the Engineer (Mr. J. D. Smith) finally decided to demolish the smaller of the two old benches, and instal in place of it a bench containing five through settings of eight retorts complete, with modern stoking machinery, coal-handling plant, electrical generating plant, and accommodation for a future installation of coke-handling plant. The complete contract for the whole of this work, including the pulling down of the old bench and the excavating and concrete foundations for the new one, was entrusted to Messrs. Robert Dempster and Sons, of Elland, to whom much credit is due for the completion of the whole contract in so short a time.

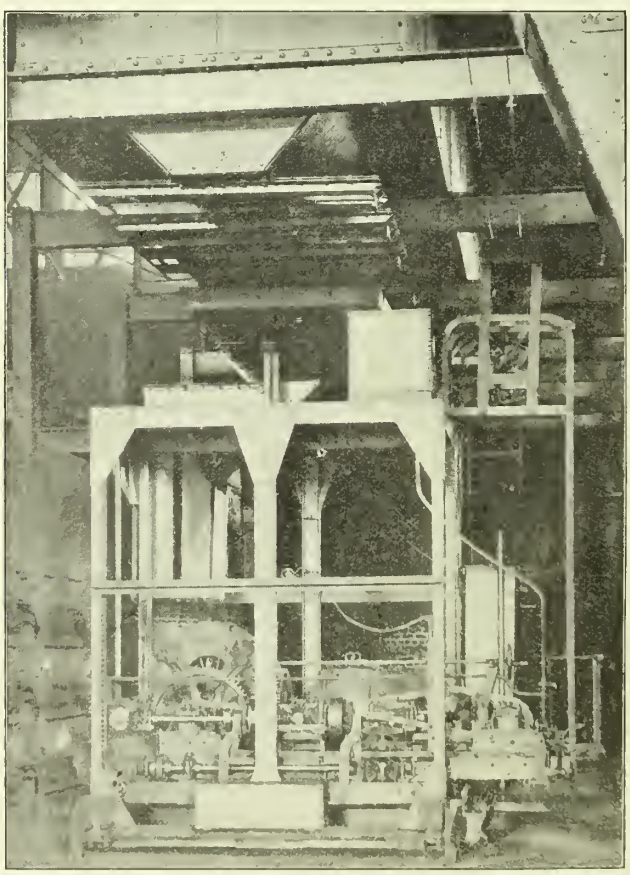
The building of the bench was commenced on March 11, and the settings were completely dried and ready for gas-making on July 15. The retorts are ⌂ shaped, 22 inches wide by 16 inches deep by 20 feet long. The settings are built on Dempster's patent regenerator system, with the furnaces on one side only—viz., on the opposite side to the charging machinery—thereby reducing the furnace work. The subway on the furnace side is 8 feet deep by 12 feet wide; while on the stoking machinery side the subway is the same depth, but only 9 ft. 9 in. wide, as there is nothing to do on this side except to regulate the admission of secondary air and to regulate the dampers. The subways are provided with special ventilators for extracting superheated air. The front walls of the bench are packed with slag-wool to prevent any loss of heat by radiation; and the whole bench is securely braced together by stout buck-stays, cross joists, and other bracing.

The furnace charging door and opening in the brickwork have been specially shaped so that the coke from the machine charges when put out can pass freely into the furnace without choking; and a special furnace charging shoot has been made, suitable for use with the "pusher-out." Another special feature of the new bench is the fact that the ascension pipes are on one side only; each through retort being provided with one 8-inch diameter ascension pipe. This is, of course, somewhat of a departure from the usual Scotch practice where a minimum of 20-candle power gas is the rule. Results, however, fully bear out the wisdom of the scheme, as the photometer tests show a gain of ½ to 1 candle power by the new plant as compared with former results. The ascension pipes are fixed on the furnace or discharging side of the bench; thus minimizing the work to be done on the other side to opening and closing the mouthpiece lids and the operation of the stoking machine.

Still another special feature of the plant is to be found in the hydraulic main, which has been arranged with a continuous open seal for the whole length of each hydraulic over each arch, sufficiently wide to allow of cleaning out operations (should these ever be required) with a minimum amount of trouble, as this seal chamber is only covered by light loose lids fitted with a handle, merely to keep dust out of the main. A tar-tower has been connected up to the tar main and the retort-house governor fixed to the foul main, both of which will have helped to obtain the increase in the illuminating power of gas made in the new setting. In the same contract, an Everitt's tar-extractor was included, which was fixed on the inlet pipe to the existing condensers. The working of this has resulted in an immediate reduction of 50 per cent. of the naphthalene troubles, as fully described by Mr. J. D. Smith in his paper read before the recent meeting of the North British Association, and given in the "JOURNAL" for July 30, p. 323.

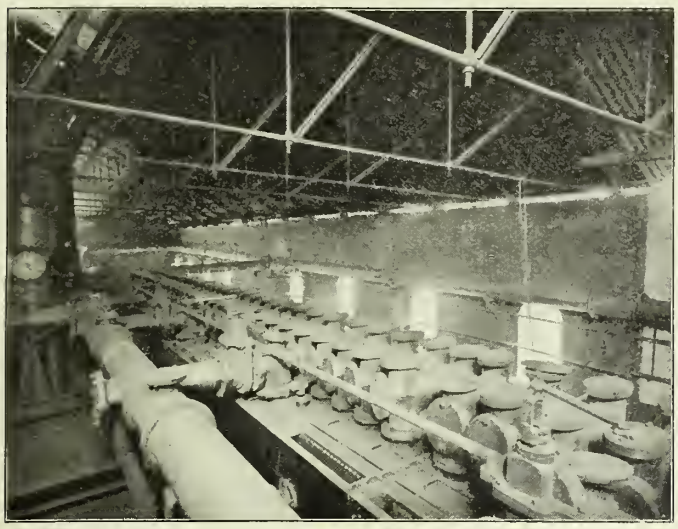
The stoking machinery consists of a combined charging and discharging machine, the motions of which are power driven. The power is obtained from one electric motor; all speeds and various motions being worked by one controller handle—thus reducing the work to the simplest proportion. The power is transmitted from the motor to the charger, pusher, and travelling and hoisting gears by means of Toogood's patent double-coil friction clutches, of which Messrs. Robert Dempster and Sons, Limited, are the sole makers. The machine is very strongly built and very compact in construction, measuring only 14 ft. 9 in. high, 12 ft. 8 in. deep, by 10 ft. 2 in. wide. The charger can be worked so as to throw any weight of coal into the retort at the will of the operator. It has already been found that the resulting coke is of far harder and superior nature to that obtained from the same coal by hand stoking; this being due to the homogeneous nature of the machine charge and to the steady action of the pusher in handling the coke, and has already resulted in a higher price being obtained for the coke, which is easily pushed out and does not buckle.

Turning to the coal plant, it will be noticed that the coal is delivered into the works in hopper-bottomed waggons belonging to the Gas Company. These waggons are emptied into a large receiving hopper, from which the coal is automatically fed to the breaker, by means of Messrs. Dempster's sure-feed arrangement, at a rate of 20 tons per hour. The sure-feed is so arranged that no part of the plant can become choked through overloading. The feeding arrangement delivers the coal to a breaker, which reduces the large pieces to a suitable size and conveys it to the elevator boot. The elevator is of the cased-in type, and delivers the coal direct into a longitudinal conveyor of the lattice braced push-plate type, which is supported from the top of the series of coal bunkers running the length of the bench. In order to get as large a storage capacity as possible with the bunkers, without in any way altering the roof, the conveyor was arranged to pass through the principals and the bunkers to come up as high as possible under them. By this means bunker capacity of 80 tons has been obtained. The outlet doors from these bunkers have been so arranged with mechanism that one simple opening device on the machine will operate all the doors.



The Combined Charging and Discharging Machine.

The complete coal plant is driven by a motor, which is a duplicate of the one that is on



The Hydraulic Main Arrangements.

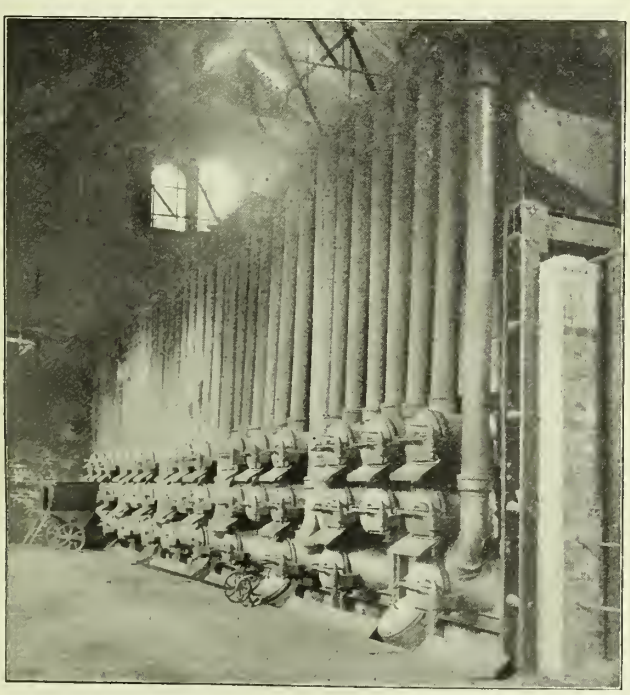
the stoking machine; so that full advantage may be taken of the interchangeability of parts.

The generating plant consists of a 45 B.H.P. "National" gas-engine, driving a 42 B.H.P. dynamo by a 9-inch belt; the engine and dynamo having purposely been installed larger than necessary, in order to develop sufficient power for possible future extensions, or for power to drive a coke conveyor should one be adopted in the future. The Manager has displayed great foresight in the arrangement of his switchboard, which is provided with a three-way switch coupled in such a manner that the whole plant can be worked from his own generating plant or from the town's electric supply; both being at the same voltage—viz., 460. In this way, should it be found more economical for light summer loads to work from the town's supply, it can be done very readily; or the generating plant may be stopped without inconvenience for repairs, if found necessary. The supply of gas to the gas-engines is taken direct from the gasholder; the pressure being reduced to suit the engine. A new power house has been built, with workshops and overhead stores alongside (which was also built by Messrs. Dempster and Sons), which is very spacious, and neatly finished in glazed tiles of a pleasing colour scheme.

The heats of the new retorts now at work are even end to end. The retorts are very economical in fuel consumption; and the plant as a whole leaves nothing to be desired. It is evident that full advantage has been taken of the existing arrangement of the works; and Mr. Smith is to be congratulated on the able way he has provided for dealing with any call on his gas supply.

A company of invited guests, including representatives of the Town Council and a number of gas managers, assembled in the retort-house, to take part in the ceremony.

Mr. J. W. Broadhead, of Messrs. Robert Dempster and Sons, Limited, of Elland, the Contractors, said that, on their behalf, they were pleased to have with them Mr. James Johnstone, the Chairman of the Stirling Gaslight Company, who would put the plant into operation. The installation consisted of through retorts, in five arches. There were no ascension pipes on one side of the bench; so that the work of the machine attendant was confined to the opening and closing of the mouthpiece doors and working the machine itself. The coke required for the furnace was pushed out on the other side, and fell direct from the oven into the furnace. It was a most complete installation for a gas-works, not only of that size, but of almost any size in the United Kingdom. There was a coal-elevator, which carried the coal direct from the waggons into overhead bunkers capable of holding 80 tons untrimmed, and 100 tons trimmed. In addition to the plant in the retort-house, there was electric generating plant in the workshops across the yard, from which the power was derived for running the machinery. Before asking the Chairman to officially put the machinery into operation, he could not allow the opportunity to pass without making a small presentation to him, to celebrate the occasion. He had pleasure in presenting him with a silver rose bowl, with the inscription upon it "Presented to Jas. Johnstone, Esq., Chairman of the Stirling Gaslight Company, at the inauguration of the stoking machinery and new carbonizing plant at the Stirling Gas-Works, 17th September, 1907." He presented the bowl as a small token of the esteem and regard in which Mr. Johnstone was held by the Contractors, and by all who were then present. He hoped he would be long spared to act as Chairman of the Company, and that he and his colleagues, and Mr. Smith, the Manager of the works, would always look back upon this occasion with pleasant memories.



Inside the Retort-House.

The Chairman said he had no idea there was to be anything of this kind, and he did not know any reason why such a beautiful rose bowl should be given to him. The only reason he could think of was that in all their work they had got on very well with the Contractors. He thanked them heartily for the present.

[The Chairman then charged a retort, the operation occupying only a few seconds; and he discharged another, which was accomplished in less than thirty seconds. Afterwards the work of charging and discharging several retorts was illustrated by the workmen. The duration of the charges, it was explained, would be six hours.]

The company were subsequently entertained by the Gas Company to luncheon in the Station Hotel.

Mr. J. Hepworth (Edinburgh) proposed the toast of "The Stirling Gaslight Company." He was glad, he said, to be the medium of voicing the pleasure they had had in seeing the latest addition to the works of the Stirling Gaslight Company. He had had some little acquaintance with the Stirling Gas-Works in his time. A great deal of water had passed under Stirling Bridge since he first visited them. He was perfectly astounded when he looked round and saw the great changes which had come over the works within the last ten years. Ten or eleven years ago the annual production of gas at the works was 60 million cubic feet. Everybody would be surprised to know that to-day the Company were sending out 120 million cubic feet annually. The capital, of course, had had to be increased in the interval. The price of gas in those days was 3s. 4d. per 1000 cubic feet; and if their friends the coal merchants had not raised the price of coal, it might have been 2s. 6d. to-day. As a matter of fact, it was 2s. 6d. until the Directors, compelled by the force of circumstances, recently made it 2s. 10d. He believed that the number of consumers went on steadily growing, but not in the same proportion as the consumption increased. He was told that the number was formerly about 5000, and that there were now about 6000. He had been asking himself what this state of things was due to. The prosperity of the Company, it seemed to him, was due to two very obvious causes. In the first place, there had been enterprise on the part of the Directors and of the Manager, which had secured a largely increased consumption, and by this increased consumption the Company had been seeking to reduce, and had succeeded in reducing, the price of gas to the very low figure he had mentioned—a price lower than they were paying in Edinburgh. Then there was a second cause—and everyone of them had been forcibly reminded of this second cause, in what they had seen that day—improvements in the methods of manufacturing gas, by the adoption of such machinery and plant as they had seen. It was often said that anyone could make gas if he only had the right kind of coal. Well, that was quite true; anyone could. But to produce good gas at a cheap rate, and to produce such remarkable results as had been produced in Stirling within about ten years, meant that the best scientific methods had been brought into play and the most perfect mechanical methods had been adopted. Much of the success which had attended the efforts of the Directors was due to Mr. Smith, the Manager. In him the Company had an exceptionally able official. He had laboured strenuously, to his knowledge, to bring about the results referred to. In their Secretary—Mr. Gentleman—the Company had an official whom everyone might envy. What he had said was enough to emphasize the fact that now-a-days it was not coal alone that was wanted to make gas. They wanted the application of brains; and the adoption of machinery such as they had seen was the correct explanation of the phenomenal success of the Stirling Gas Company.

The Chairman, in acknowledging the toast, said that Mr. Hepworth had been a true friend of the Company for many years. He almost reckoned him as one of themselves. He thought the greatest cause of the success of the Company had been their Manager. They were very fortunate in securing such a gentleman as Mr. Smith. He had a thorough knowledge of everything in connection with gas making, and filled up every little crevice that he found, in some way or other. He had a faculty for seeing things before, and applying his remedies before anything took place. Had it not been for Mr. Smith, he was sure that they would not have been in the position in which they were at the present time. The amount expended on the works had been nearly £60,000. Of this, there had been £10,000 paid out of revenue for the extension and restoration of the works; and, as Mr. Hepworth had said, the production of gas was double what it was nine years ago. It had always been the aim of the Directors to serve the public in the best way

they could. They had tried at all times to keep the price to the consumers as low as possible; and it would be their endeavour to continue this course.

Mr. D. CHRYSTAL, the Solicitor to the Company, proposed "The Provost, Magistrates, and Town Council of Stirling," which was acknowledged by Bailie WATT, who said there was a fallacy abroad that there was some secret antagonism between electric light and gas light. Nothing could be further from the truth. Years ago the late Sir William Siemens said that no holder of gas shares need feel alarmed by the prosperity of the electric light industry. The representatives of the Town Council there felt impressed by what they had seen; and he knew that he was speaking the mind of his colleagues when he said that he trusted that the prosperity of the Company might continue, even in a greater degree than in the past. The prosperity of the gas undertaking meant the prosperity of the people of Stirling. The prosperity of the Company meant cheaper light for the consumers; and there should be no rivalry between those who represented the electric current and those who manufactured gas.

Ex-Provost KINROSS having proposed "The Contractors,"

Mr. J. W. BROADHEAD, in reply, said they were very pleased indeed to have had the opportunity of doing work for the Stirling Gaslight Company; and now that it was finished, they were very glad that they had been able to go through a work of some difficulty without a single hitch having occurred. In Mr. Smith they had had every assistance any contractor could possibly have, in carrying out the work. They, as Contractors, had to give certain guarantees before they began the work; and he was gratified to learn from Mr. Smith that he would have no difficulty in advising his Board that the guarantees had been more than met, and that the policy he had submitted to his Directors would bear very good results. The make of gas per ton was more; the illuminating power of the gas was greater from the same quality of coal; the fuel consumption was considerably less; the coke was of much improved quality, and realized a higher price per ton; carbonizing wages were reduced by about 1s. per ton, and would be reduced still more; and last, but not least, the work would be done under more humane conditions.

Mr. CHRYSTAL proposed the health of the Manager. There was no one man, he said, to whom the prosperity of the gas undertaking was due, more than to Mr. Smith.

Mr. SMITH, in acknowledgment, said that the prosperity of the Company was due, in very large measure, to the Chairman, who faithfully visited the works at least once a week. They could imagine what a support this gave to the Manager.

The proceedings were then brought to a close.

INVESTIGATIONS ON THE LONG-DISTANCE GAS-MAIN AT ST. GALL, SWITZERLAND.

SOME experiments upon the phenomena attendant upon the long-distance transmission of gas at high pressure were carried out during August last year, at St. Gall, Switzerland, under the superintendence of Professor A. Fliegner, of Zurich. The methods employed, and the results obtained, were described with great wealth of detail in the course of an article running through several recent issues of the "Journal für Gasbeleuchtung;" while a useful abstract of the general conclusions drawn by Dr. Fliegner from his researches was printed in the "Schweizerische Bauzeitung." The particulars given in the following lines are obtained from the two sources mentioned (see also *ante*, p. 227).

The first gas-works erected to serve the town of St. Gall were built in 1857. Owing to the growth in population of the town itself and the surrounding country, the works required enlargement about the year 1890; but only a comparatively short time afterwards the plant was found insufficient to cope with the local demand for gas. It was therefore decided to build an entirely new works; and after various proposed sites in the immediate neighbourhood of the town had been examined and rejected for one cause or other, it was finally arranged to place the new works at Riet, on flat ground near Rorschach, a village on the shores of Lake Constance close to the works supplying St. Gall with water. Thus the new gas-works were situated, roughly, 6¼ miles away from St. Gall, and 820 feet below the level of the town. The plant on the works comprised a two-lift telescopic holder, having a storage capacity of about 212,000 cubic feet, connected by means of a main 13·8 inches in diameter with two single-lift holders at St. Gall, each holder having a capacity of 330,000 cubic feet, but so designed as to be capable later on of being telescoped.

Owing to the difference in level between the works and the town, the natural ascensional power of the gas was sufficient to force it to the place of consumption as long as the demand remained reasonably small; but since it was anticipated that the consumption would soon grow, the owners decided to adopt the system of high-pressure transmission. Two Enke's blowing engines, each having a maximum capacity of 1900 cubic feet per minute, were therefore laid down, each driven by its own 16 H.P. Oerlikon electric motor. The gearing was so arranged that each blowing engine could be driven by its own motor at any of five different speeds—viz., at 36, 53, 71, 90, and 101 revolutions per minute; while by coupling both motors to one blowing engine, the latter could be driven at 130 revolutions per minute. Gas was also supplied direct from the low-level holder on the works through different mains to the neighbouring villages of Rorschach, Goldach, and Horn. These places, however, consumed but little gas; and at the time when the experiments were in progress, at least 90 per cent. of the total make was forced through the high-pressure main to St. Gall.

The experiments had for their object to ascertain the amount of energy consumed by the electric motors in driving the blowing engines at different speeds, the quantities of gas propelled through the main by the engines when running at different speeds, the general effect upon the gas (if any) produced by so propelling it at different speeds through the main, and the coefficient of friction set up during its passage. Owing to the fact that the plant at the low-level station was insufficiently equipped with meters accurately showing the total make and the proportions thereof supplied to the three villages mentioned, as well as to St. Gall itself, and also owing to the possibility of errors arising through the difference in level between the two ends of the high-pressure main, various complications were encountered in carrying out the tests. It was found necessary accurately to calculate (*e.g.*) the following factors: The capacity of the gasholder on the works per unit rise of the bell and, since the holder was telescopic, to calculate the internal diameter both of the bell itself and of the lift; to ascertain exactly the volume of gas passing into the holder from the manufacturing plant during the time when the gas passing out of the holder into the main was being measured; to measure the pressure thrown when the lift was grounded, when both lift and bell were high, and also during the interval when uncupping was taking place; and to determine with the utmost precision possible the mean temperature of the gas passing into the main. At the other end, the operations were somewhat more simple, inasmuch as it was possible before each experiment took place to pass sufficient gas into one holder at St. Gall to keep the town fully supplied during the progress of the experiment, and to use the second holder as the recipient for the gas forwarded from the works. The holder at St. Gall employed to receive the gas had also, of course, to be calibrated and to be provided with the best arrangements possible for ascertaining the mean temperature of the gas on arrival. On the whole, it was found advisable to calculate the amount of gas made on the works and sent into the high-pressure main in terms of weight, and to treat the gas received at St. Gall in a similar fashion. Owing to the nature of the intervening country, the presence of a railway, &c., the necessity for having numerous curves (some of them of sharp angle) on the main, several spots occurred at which the general ascent of the pipe was unavoidably interrupted by a brief descent. Hence a number of syphon boxes were provided for condensed water, and the opportunity was taken to utilize nine of these boxes as places for investigating the pressure, temperature, &c., of the gas on its way from the works to the final storage holder.

A profile of the main is given in fig. 1 herewith, where the upper abscissæ represent the horizontal length of the pipe in kilometres, and the lower abscissæ give its length in miles, while the ordinates show the rise in metres and English feet above sea level or the outlet of the blowing engines at the works. The small circles inscribed with black crosses rising above the main in the diagram represent stop-valves. The small black squares depending

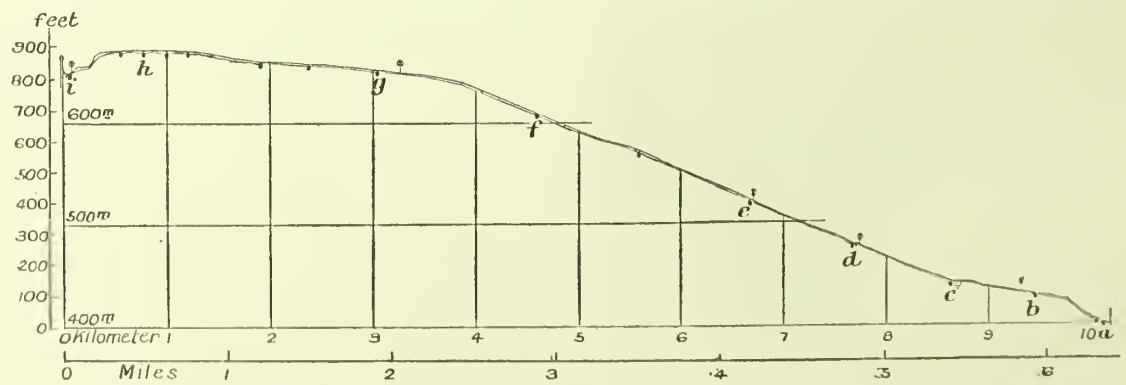


Fig. 1.—Profile of the Long-Distance Gas-Transmission System from Riet to St. Gall.

from the main indicate the syphon boxes; those at which the investigations were carried out being distinguished by small letters of the alphabet from (*a*) close to the factory to (*i*) near St. Gall. Further details as to the precise horizontal distance of each syphon box from its neighbours and from the factory, and its height above the latter, are recorded in Table I. after recalculation of the author's metric data into miles and yards and into feet respectively. It should perhaps be explained that the length of main between the boxes *a*—*b* contained a good many sharp curves as viewed on a ground plan; the length *b*—*c* contained one curve, but was otherwise straight; the length *c*—*d* contained a curve almost at right angles, and shortly before the point *d* passed upon a stone bridge over a railway, dropping into the ground again on the other side; the length *d*—*e* was mainly straight; the length *e*—*f* contained numerous gentle curves and a short fall: the length *f*—*g* was also almost straight; the length *g*—*h* contained the highest point of the whole main but was almost horizontal; the length *h*—*i* contained numerous horizontal curves of fairly short radii. The portion of main between the blowing engines and the syphon box *a* and the corresponding portion between the syphon box *i* and the governor house at St. Gall also contained syphon boxes; but the lengths were too short to render it convenient to carry out experiments in these places. The weather remained fairly favourable during the whole period of the tests especially in regard to the barometer, for only once was an alteration in the height of the mercury equal to 0·031 inch observed. On the other hand, the temperature varied a good deal—changing on one occasion by 4·7° Fahr. and on several other occasions by about 2° Fahr. during a single test. The temperature, however, only affected the conversion of the barometric height to the freezing point, and therefore did not produce much effect, more particularly because the temperature of the air was generally over 68° Fahr.

Table I.—*Positions of Syphon Boxes.*

Mark.	Distance from Blowing Engines. Miles.	Yards.	Height Above Blowing Engines. Feet.
a	0	111·5	10·5
b	0	770·6	91·2
c	0	1675·0	130·0
d	1	960·0	257·0
e	2	280·0	398·0
f	3	810·0	684·0
g	4	740·0	825·0
h	5	1450·0	886·0
i	6	490·0	820·0

Experimental Methods.

As will appear later on, seven different complete experiments were carried out; the first under natural draught—that is to say, the gas being allowed to travel through the main by virtue of its own ascensional force—and the remaining six at different speeds of one or other of the blowing engines. The experiments lasted for four complete days; one being undertaken each morning or afternoon. The gas was first of all sent through the main under the conditions which were afterwards to be examined during a period of about half-an-hour, in order that thermal equilibrium might be attained, and then the experiment itself was begun, continuing as long as the store of gas previously made on the works would last. A delay occurred at the middle of each day while a further make of gas, sufficient for the afternoon's experiment, was being collected. Thus each individual experiment occupied from two-and-a-half to three hours. During the whole time of each experiment, measurements were made every fifteen minutes at both ends of the transmission system and at the nine syphon boxes already mentioned, of the various data which it was necessary to collect. Some of the temperatures, however, were only observed once in thirty minutes.

The apparatus represented by fig. 2, and shown in somewhat greater detail by fig. 3, was used at each syphon box to measure the temperature of the gas in the main; a thermometer being held by means of a cork inside the closed pipe descending within the suction tube of the box at such a point that the mercury bulb stood on a level with the axis of the main. The thermometer was withdrawn as quickly as possible each time it was read, and put back into position. The centre opening of the reducing T-piece led to a water-gauge for ascertaining the pressure. At first, a solution of zinc chloride having a specific gravity of 1·8 was used in the gauges, instead of plain water, as it was believed that the pressures would be such as to render the reading of a water-gauge in the open air by a man of ordinary height very difficult. The solution, however, proved unsuitable, inasmuch as it lost its homogeneity; and the use of plain water was therefore reverted to. The pressure of the gas in the two holders at the works and at St. Gall respectively was indicated by means of the ordinary water-gauges already in existence. The temperature was measured in a totally different way at the two ends of the main. On the works a thermometer was placed in a syphon box which was close to the mouth of the outlet pipe; but at St. Gall the temperature was estimated by graphically deducing the mean of the readings given by four thermometers suspended at different heights and at different positions in a horizontal plane within the holder.

The device employed for dropping the thermometers into the holder from the crown of the bell and for quickly withdrawing them when the readings were made is shown in fig. 4 where *a* is a cock, *b* a vessel containing an annular water seal, *c* a bell dipping into the seal, and *d* an orifice closed by a cork through which the string carrying the thermometer passed. In order to minimize the danger of breaking the thermometers when withdrawing them, a depending cone of paper was generally fixed by the observers at the mouth of the device. Serious irregularities were found in the readings of the St. Gall thermometers, owing to the effect of the sun, clouds, or passing showers on the exposed holder; the differences indeed ranging, according to the position of the individual thermometer, from 16° to 40°. The rise of the bell in each holder was measured by fitting them with three rods graduated in millimetres arranged symmetrically about their circumference and taking the mean of the three readings thus obtained. In the case of the St. Gall holder, the readings gave at once the capacity of the vessel; but, as already mentioned, in the works holder further corrections were required to allow for the difference in diameter between the bell and the lift. The mathematical processes used by the author in eliminating the

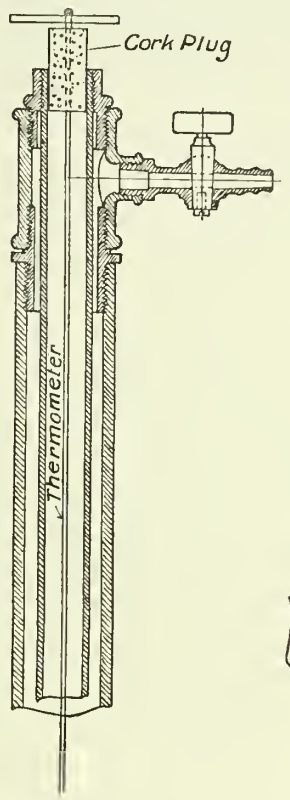


Fig. 2.

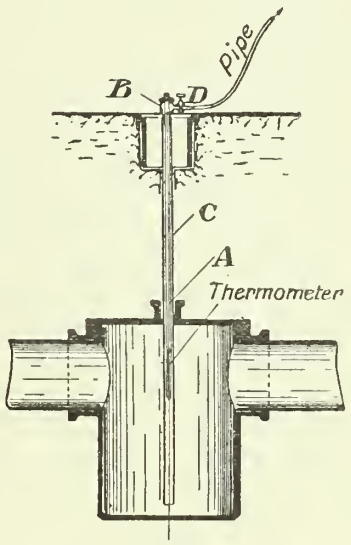


Fig. 3.

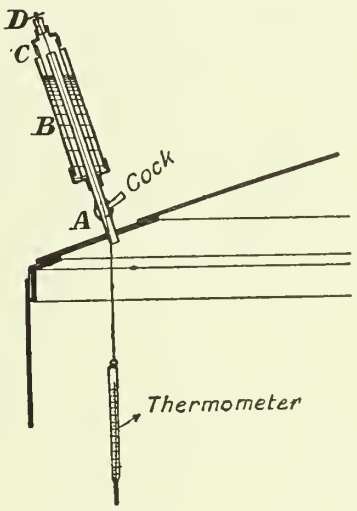


Fig. 4.

effect of this difference in diameter and of the difference in pressure caused by the grounding of the lift are recorded with great minuteness in Dr. Fliegner's original communication.

The pressure of the atmosphere was measured in the ordinary way by means of barometers in the immediate neighbourhood of the works and of the town; small corrections being made for differences in level between the two barometers and the outlet of the blowing engines or the position of the holder inlet at St. Gall. The atmospheric pressures prevailing at the nine different syphon boxes on the main were deduced by a graphic method from the readings obtained at the two ends of the pipe, upon the assumption that the pressures varied regularly with the altitudes. A system of electric bells was provided over the whole main and extending to the two ends of it, in order that all the different readings might be taken simultaneously—numerous men being engaged, under the leadership of Dr. Fliegner, in making the necessary records.

Determination of the General Gas Constant.

The first work undertaken was a determination of the general gas constant—*i.e.*, the value of R in the equation $p\,v = R\,T$. In calculating out the values, the corrected barometric heights were converted into kilogrammes per square metre—*i.e.*, into millimetres of water column—upon the basis legalized in Germany that one cubic metre of ice-cold mercury weighs 13,595·63 kilogrammes. The saturation of the atmosphere at the lower end of the main was estimated with the aid of an August psychrometer; whereas that at St. Gall was obtained by a process of interpolation from the reports of the Swiss meteorological station in the town. Six tests were generally made at St. Gall and three at the works during the progress of each experiment, to ascertain the value of the constant ϵ—that is to say, the weight of the gas in comparison with that of an equal volume of moist air. It was considered more correct to calculate the density of the gas in comparison with saturated air, irrespective of the actual hygrometric state of the atmosphere at the time, because the air used in the experiments remained in contact with water in the seals of the apparatus, and was therefore presumably saturated with moisture. The values obtained for ϵ were finally employed to determine R.

Table II.—*Values of ϵ and R.*

—	Maximum.	Minimum.
ϵ at works	0·4833	0·4666
ϵ at St. Gall	0·5122	0·4769
R at works	63,242	61,078
R at St. Gall	61,906	57,529
Mean values for R over the whole system	62,441	59,737

After averaging the different individual figures obtained during each separate experiment at the two different ends of the transmission main, maximum and minimum meau values for ϵ, and corresponding values for R were found, which are recorded in Table II. herewith. The values for R quoted in the third and fourth horizontal lines of the table were used in all subsequent calculations when conditions at either end of the main were being studied separately. But when the phenomena prevailing at the different points along the main, or over the transmission system as a whole, were involved, the means of the two end values were taken, as shown in the last line; and these means were used in the appropriate experiments. After averaging them for each individual experiment, the figures obtained for R at St. Gall were invariably smaller than those found at the works; so that the gas was always comparatively heavier at the outlet of the high-pressure main than at its inlet. This peculiarity was not due to any irregularities in the rate at which the gas travelled through different parts of the main but to variations in the pressure so established. Indeed, the relationships between the values of R at the lower and the upper ends of the main in experiment No. IV., where the gas travelled at the lowest speed, and in experiment No. VII., where it travelled most rapidly, were practically identical; whereas in experiment No. I, where the speed was slightly greater than in IV., the two values for R differed greatly. The peculiarity was not due to the separation of moisture; for inasmuch as water vapour is heavier than gas, such separation would have involved a decrease in specific gravity. Presumably the increase in density was due to some physico-chemical change—perhaps the removal of lighter constituents by the deposited water, perhaps the partial condensation of heavier constituents during the intervals between the tests, or during the prevalence of lower temperatures; the heavier constituents being afterwards partially volatilized again when the temperature rose.

Measurements of the Volumes of Gas, Etc.

In Table III. are collected, from several of the tables printed by the author in his original communication, the more important data obtained during the six different experiments under pressure relating to the amount of gas passed per unit-time, and per revolution of the blowiug engine; also the amount of energy supplied by the motors to the blowing engines, and by the blowing engines to the gas, together with figures showing the efficiency of the whole plant. The Roman numerals in the top line of the table represent the order in which the different experiments were carried out, the order in which they are recorded being that of increasing numbers of revolutions per minute and of gas forwarded per second, as will be seen on inspecting the horizontal lines 3 and 4. The second line of the table shows which of the two blowing engines was employed; the gas in experiment No. I. passing from the lower to the upper end of the forwarding main merely under the impulse given by its own specific gravity. The following lines of the table do not seem to require explanation beyond the statement that the lines marked 6a, 7a, 8a, and 12a have been added by us for the purpose of indicating the British equivalents of some of Dr. Fliegner's metric values. The horse-powers in lines 9 and 10 have been left in their German forms. Engine No. I. used in experiment No. III. began to run hot at the high speed employed during the test. Hence the percentage efficiency during that test, as shown in line 11, came out lower than in the preceding experiment No. VII. Had heating not occurred, the percentage efficiency would probably have shown a still higher value, continuing to rise with increasing speeds of the engine as in the former cases. Experiment No. III. had indeed to be curtailed owing to the heating of the engine.

The whole research did not afford any facilities for judging in what parts of the plant loss of energy took place. Comparing lines 5 and 7 in the table, it will be seen that the pressure on the outlet side of the blowing engine was but little higher than that on the inlet side, so that no serious amount of leakage took place about the engine. Comparing experiment No. IV. with No. I., it will also be seen that a smaller quantity of gas was sent through the main when the engine was running at 36·82 revolutions per minute than when the gas travelled by virtue of its own weight. Examining the figures in line 13, it will be noticed that the efficiency of the same blowing engine decreased with increasing speed, but that the two engines differed somewhat one from the other in that particular. One cause of the decrease in efficiency was doubtless leakage; and since engine No. II. never ran hot, it was presumably more leaky than engine No. I. Another cause for the fall in efficiency may be found in the fact that the gas generally rose in temperature in the engine—giving up part of its heat to the engine. On the other hand, the walls of the engine were constantly raised in temperature by friction. On entering the engine, therefore, the gas was warmed, so that a smaller quantity by weight of it was drawn in than would have been the case if no rise in temperature had taken place. This phenomenon continued until equilibrium was reached between the amount of heat evolved and that lost by radiation. Comparing lines 6 and 8 in the table, it will be observed that experiment No. IV. was exceptional, inasmuch as the gas was hotter on the inlet than on the outlet side of the engine—or, in other words, that the walls of the blowing engine were at first cooler than the gas in the works holder. Hence a condition of thermal equilibrium was not attained during the time of the experiment in question.

Investigations at Different Points along Main.

Table IV. reproduces in somewhat different form the data given

Table IV.—*Length and Rise of Each Section of Main.*

Section.	Length in Yards.	Rise in Feet.
a-b	665	80·8
b-c	898	39·0
c-d	1045	126·0
d-e	1075	141·5
e-f	2300	286·0
f-g	1687	141·5
g-h	2482	61·4
h-i	776	−67·2

in Table I. relating to the nine syphon boxes on the main where measurements of pressure and temperature were carried out. Table IV. indicates the length of each section in yards and the rise in feet; the last section, which iucludes the final descent from the summit into the town of St. Gall, therefore shows a negative rise or fall. In Table V. are condeused from the very voluminous tables printed by Herr Fliegner iu his origiual paper figures indicating the maximum and minimum pressures found at each syphon box during the progress of four out of the seven

Table III.

1	No. of Experiment.	I.	IV.	VI.	V.	II.	VII.	III.
2	No. of blowing engine	Without	II.	I.	II.	II.	I.	I.
3	Revolutions per minute	—	36·82	53·06	72·35	91·37	103·57	131·47
4	Kilos. of gas forwarded per second	0·1738	0·1530	0·1984	0·2533	0·3068	0·3727	0·4566
5	Inlet side—absolute pressure in kilos. per square metre	—	9,948	9,915	9,942	10,005	9,937	9,971
6	Ditto—temperature in degrees Centigrade	—	23·57	22·05	21·87	24·84	22·82	21·01
6a	Ditto— ,, ,, ,, Fahrenheit	—	74·43	71·69	71·37	76·71	73·08	69·82
7	Outlet side—absolute pressure in kilos. per square metre	—	9,997	10,081	10,233	10,458	10,631	11,066
7a	Ditto— ,, ,, ,, inches of water	—	394	397	403	412	419	436
8	Ditto—Temperature in degrees Centigrade	—	23·39	23·27	24·32	28·74	29·18	30·77
8a	Ditto— ,, ,, ,, Fahrenheit	—	74·10	73·89	75·78	83·73	84·52	87·39
9	Work done upon the gas in H.P.	—	0·186	0·821	1·782	3·432	6·342	12·430
10	Energy supplied by the motor in H.P.	—	3·604	5·052	6·800	10·050	14·428	30·175
11	Percentage efficiency of the whole plant	—	5·17	16·25	26·20	34·14	43·96	41·19
12	Cubic metres of gas forwarded per revolution measured on inlet side	—	0·4617	0·4199	0·3805	0·3728	0·3968	0·3886
12a	Cubic feet of ditto	—	16·3	14·85	13·45	13·17	14·02	13·73
13	Comparative volumetric efficiency of blowing apparatus	—	100	90·94	82·40	80·74	85·93	84·17

TABLE V.—*Effective Pressure at Different Syphon Boxes in Tenths of an Inch Water Column.*

Experiment No.	Close to Blowing Engine.	a.	b.	c.	d.	e.	f.	g.	h.	i.
IV. .	54·0–56·0	52·4–54·4	33·5–35·8	53·2	55·6–57·4	58·2–63·4	65·8–69·8	63·8–66·6	56·3–57·0	46·1
VI. .	98·4–103·0	94·4–100·5	91·5–98·4	89·0–95·0	87·5–93·5	87·8–93·0	86·2–92·2	81·1–83·1	61·0	46·1
V. .	148 0–156·5	146·5–153·5	138·5–147·5	134·2–139·5	128·3–132·5	121·5–123·2	113·5–117·0	99·2–101·5	67·0–67·8	48·8
VII. .	303·0–317·0	296·0–310·0	284·0–295·0	267·0–279·0	246·0–258·0	227·0–237·0	191·0–197·0	153·0–157·5	83·8–84·6	51·2

TABLE VI.—*Mean Speed of Gas in Metres per Second.*

	a–b.	b–c.	c–d.	d–e.	e–f.	f–g.	g–h.	h–i.	Average.	Average Speed, Feet per Second.
I.	3·139	3·154		3·176	3·195	—	3·192	3·166	3·172	10·40
IV.	2·839		2·849	2·853	2·865	2·883	2·863	2·823	2·858	9·38
VI.	3·742	3·754	3·765	3·776	3·803	3·835	3·814	3·791	3·796	12·45
V.	4·592	4·612	4·631	4·647	4·687	4·736	4·726	4·716	4·684	15·36
II.	5·497	5·523	5·562	5·595	5·657	5·715	5·723	5·721	5·638	18·50
VII.	6·490	6·517	6·559	6·609	6·706	6·819	6·841	6·869	6·714	22·00
III.	7·904	7·975	8·045	8·120	8·283	8·448	8·540	8 676	8·282	27·20

TABLE VII.—*Observed Coefficients of Friction.*

	a–b.	b–c.	c–d.	d–e.	e–f.	f–g.	g–h.	h–i.	Average.
I.	0·03419	0·01835		0·02778	0·02033	Negative	0·04072	0·01954	0·02080
IV.	0·02045		0·01928	0·02005	0·01931	0·02691	0·02092	0 03465	0·02217
VI.	0·02681	0·01658	0·02338	0·02049	0·02096	0·02331	0·02360	0·03362	0·02300
V.	0·02706	0·01775	0·02362	0·02602	0·01871	0·02250	0·02335	0·02673	0·02254
II.	0 02164	0·02649	0·01647	0·02440	0·01968	(0·00892)	0·02824	0·02982	0·02382
VII.	0·02113	0·01546	0·02131	0·01951	0·01756	0·02101	0·02143	0·02658	0·02021
III.	0·02404	0·02192	0·01442	0·02047	0·01837	(0·01267)	0·02466	0·02510	0·02118

TABLE VIII.

1.	No. of Experiment.	IV.	I.	VI.	V.	II.	VII.	III.
2	Mean speed of the gas.	2 858	3·172	3·796	4·684	5·638	6·714	8·282
3	Mean coefficient of friction observed	0·02217	0·02080	0·02300	0·02254	0·02382	0·02021	0 02118
4	Coefficients calculated by Grashof's formula	0·02155	0·02115	0·02049	0·01980	0·01925	0·01877	0 01825
5	,, ,, ,, Arson's ,, ...	0·02776	0·02742	0·02691	0·02642	0·02607	0 02579	0·02551
6	μ in metric formula	0·7867	0·8091	0·7708	0·7731	0·7505	0·8087	0·7793

experiments; these figures having been translated from millimetres of effective pressure into tenths of an inch water column. The figures relating to the other three experiments have been omitted from the present abstract, inasmuch as, owing to the employment of a solution of zinc chloride in the gauges, some doubt appears to have arisen as to the accuracy of the readings. The individual figures from which Table V. has been prepared show that irregularities in pressure up to about 10-10ths of an inch water column were felt over almost the whole main—that is to say, up to a distance of 5½ miles from Riet. The irregularities, of course, diminished in amount with increasing distances from Riet; whereas original variations of much less than 10-10ths were wiped out at considerably shorter distances. It is worth remarking that some two years before the investigations now being described were carried out, a preliminary test of the main and blowing engines was made. The average pressure in syphon box *a* was approximately 185-10ths; but it exhibited variations up to 13·8-10ths from the normal, which synchronized with the revolutions of the blowing engine. On examining the plant, the engine was found to have settled somewhat on its bed, and had begun to bind at one particular spot. This, no doubt, affected its delivery, perhaps by causing a blade to bend. During the more recent experiments, variations in pressure were also noticed; but both at the point *a*, and at the gauge immediately after the engine, they did not attain one-tenth of their former dimensions. On the other hand, the readings of temperature which were made at the different syphon boxes showed that the gas invariably sank quickly to the temperature of the soil, and that only when the blowing engine became seriously hot was an elevated temperature of the gas to be detected at syphon box *a*—*i.e.*, 100 odd yards from the engine. Table VI. shows the mean speed in metres per second, deduced from numerous observations during the progress of each separate experiment at which the gas was found to be travelling through the various sections of the main. The experiments in Table VI. are put down in the order of increasing speeds of the blowing engines and increasing volumes of gas sent into the St. Gall holder, as was also the case in Table V. The penultimate vertical column of Table VI. contains the average readings relating to the eight different sections of the main, also quoted in the metric data of metres per second; while we have added a final column converting these figures into feet per second.

The Coefficients of Friction.

With the aid of the observed pressures and temperatures of the gas at the different syphon boxes, the specific volume of the gas v, was calculated from the general gas equation. The arithmetical mean of the values so obtained for each two neighbouring boxes was then deduced and considered as the mean constant specific volume of the gas during its passage through each separate section of the main. From the known weights of gas passing, its mean speed w was calculated, as already indicated in Table VI.; and finally the coefficient of friction was worked out by means of the usual hydraulic formula for ascending mains,

$$v\,\delta p = h + \frac{\lambda\, l.w^2}{d\ 2g},$$

where g is the metric acceleration of gravity (9·81), d the diameter in metres, l the length, and h the rise of each section of the main in metres, δp the fall in pressure in millimetres of water column, and λ the mean coefficient of friction. The figures thus obtained for each separate section of the main in the seven different experiments are reproduced in Table VII., the last column of which contains the averages. For the section *f-g*, the coefficient appeared to be negative in experiment No. I., and much too low in experiments Nos. II. and III. These were the tests in which zinc chloride solution was used in the gauges, and doubtless this solution was responsible for the errors. The figures were accordingly rejected.

The coefficients in Table VII. represent the friction set up by the different sections of the main, or by the entire length of it as a whole; no allowance being made for special amounts occurring locally through the presence of bends, stop-valves, or the numerous other syphon-boxes over and above those where measurements were carried out. An inspection of the table will show that the individual coefficients varied very largely—even those obtained during the course of a single experiment. This irregularity could not have been due to the action of the bends, stop-valves, &c., known to be present in the main; for on making special corrections to eliminate their effect, in the manner employed by hydraulic engineers, fresh coefficients were deduced which agreed among themselves no better. The variations in the original coefficients, however, were too regular to be attributed to experimental errors. For example, in nearly all the experiments the values for λ attained their maxima in the section of the main *h-i*; whereas their minima in the more trustworthy experiments Nos. V. to VII., where simple water was used in the gauge-glasses, occurred in the section *b-c*. In all probability, therefore, the main instituted an abnormal amount of friction in certain places, owing perhaps to the entry of foreign matter while it was being laid. The last column of Table VII. contains the average coefficients obtained from the individual values in the usual fashion; but in experiment No. I., owing to the uncertainty attaching to most of the readings of the pressure gauges, the dimensions of w and λ were deduced from the corrected pressures and temperatures immediately after the idle blowing engine and at the syphon-box *i*. In the best experiments, Nos. V. to VII., the mean coefficients decreased with increasing speeds of the gas, as is the case during the propulsion of air and of water through mains; the other experiments, which did not give parallel results,

merited less attention—Nos. II. and III. because the liquid used in the gauges was the zinc chloride, No. IV. because the pressure was lowest. The experiments were too few in number to allow the relationship between the magnitudes w and λ to be determined more precisely.

Taking the general mean of the coefficients obtained in all the experiments where the gas was forced through the main by a blowing engine, the coefficient of friction became

$$\lambda = 0{\cdot}02215 \text{ (forced draught)},$$

while the general mean of experiment No. I., where the gas had to travel under the impulse of its own gravity, gave

$$\lambda = 0{\cdot}02080 \text{ (natural draught)}.$$

Hence the use of a blowing engine increased the resistance of the main—presumably because the engine did not actually compress the gas. Owing to the absence of compression, each time the outlet side of the engine was in communication with the main, some gas passed backwards from the main into the engine—regular pulsations being established which increased the total friction. The general effect of the Enke blowing engine was thus to increase the resistance established in the main by 6·5 per cent. As it would appear judicious to quote the coefficient obtained when forced propulsion of the gas was employed (in somewhat round numbers), the result of the whole tests may be said to give the value $\lambda = 0{\cdot}025$, which is identical with the factor commonly adopted in making calculations relating to water supply when the liquid travels at similar velocities.

Other Methods of Calculation.—It may be of interest to compare the coefficients of friction deduced in the manner outlined from the experimental data collected during the research with such as are given by the use of various formulæ already published. Based on tests with air carried out by Weisbach, Grashof has proposed the following empirical formula :—

$$\lambda = 0{\cdot}01355 + \frac{0{\cdot}001235 + 0{\cdot}01d}{d\sqrt{w}},$$

where d is in metres and w in metres per second. The results given by this formula are recorded in line 4 of Table VIII., in which Dr. Fliegner's own figures in lines 2 and 3 are repeated from a previous table for ease of comparison. In experiment No. I., where the gas moved under the influence of its ascensional force alone, Grashof's value for λ agreed fairly well with that obtained experimentally; but in the other experiments, where blowing engines were used, his formula yielded coefficients that were undoubtedly too low.

According to an article written by Niemann, in Schmitt's "Der Städtische Tiefbau," M. Arson has suggested

$$\lambda = \frac{\delta g}{1000}\left(\frac{a}{w} + b\right),$$

where a and b are constants decreasing in magnitude with increases in the size of the main, a varying almost in inverse proportion with d, and b more slowly. Taking the values $a = 0{\cdot}000125$ and $b = 0{\cdot}000310$, the results given by Arson's formula are quoted in line 5 of Table VIII. Those referring to experiment No. I. are 1·32 times as great as Fliegner's direct results; in the other cases, they range from 1·09 to 1·28 times too great. Arson's formula, indeed, is already in disrepute.

Employing the usual formula for the volume of gas passing

$$Q = \mu\sqrt{\frac{d^5 H}{\epsilon l}}$$

the values for the metric constant μ deduced from the volumes of gas passing through the St. Gall main and from its average density during the investigation of the system are collected in line 6 of Table VIII. The average of all the figures there given is 0·7826. This is 1·101 times the constant (0·7106) quoted by Niemann after Redtenbacher and Schilling, and 1·175 times the constant (0·6658) actually used by Niemann himself. There is undoubtedly some error in certain of these older constants, inasmuch as they have been calculated from the specific gravity of a gas corrected to standard conditions—*i.e.*, 0° C. and 760 mm. barometer, and from the volume of a gas as drawn from a holder or passed through a meter in other conditions.

In conclusion, it should be said that the St. Gall experiments gave lower coefficients of friction than earlier work on the same subject. To some extent, the apparent decrease in friction may have been due to the methods of calculation employed; but the whole of the difference could not be explained in this way. In all probability cast-iron pipes run smoother inside than formerly; the sockets are smaller, and therefore the finished joints are more level. A great part of the St. Gall main was washed out before being taken into use, and the cleansing operation was presumably beneficial. Moreover, separation of naphthalene was unknown in the main, and perhaps the pipes studied on former occasions may have been slightly blocked with crystals.

The production in Germany of sulphate of ammonia for the year 1906 amounted to some 200,000 tons, which was an increase of about 25 per cent. over the previous year's output; and consequently the importation both into Germany and at Hamburg fell off considerably. The imports to Hamburg amounted to 7646 tons, against 11,602 tons in 1905. The exports from the United Kingdom to Germany amounted to 17,545 tons, compared with 29,009 tons in 1905.

THE ILLUMINATING POWER, IN ORDINARY AND INCANDESCENT BURNERS, OF COAL GAS, WATER GAS, AND MIXTURES OF THE TWO GASES.

[Abridged Translation, with Comments, by W. J. Atkinson Butterfield, M.A., F.I.C., of a Communication presented to the Meeting of the International Photometric Committee in Zurich, July 18 to 20.—Continued from p. 684.]

By Emile Sainte-Claire Deville.

The following table presents the more important data of the author's detailed statement, rendered as far as possible into English terms.

Table V.—*Illuminating Duty in the Incandescent Burner of Various Gases.*

Nature of Gas.	Water Gas.				Mixtures in Order of Increasing Calorific Power of								Coal Gas.				Cannel Gas.
	a.	*b.*	*c.*	*d.*	96·2 c. 3·8 j. (1)	893 b. 107 h. (2)	43·6 a. 56·4 e. (3)	72·2 a. 27·8 f. (4)	71·2 d. 28·8 g. (5)	66·7 b. 33·3 h. (6)	75·0 c. 25·0 j. (7)	38·3 a. 61·7 f. (8)	39·7 d. 60·3 g. (9)	29·2 b. 70·8 h. (10)	50·0 c. 50·0 j. (11)	32·0 c. 68·0 j. (12)	*e.*	*f.*	*g.*	*h.*	*j.*
Density at 0° C. and 760 mm.	0·4816	0·4832	0·4175	0·4196	..	..	..	..	..	..	..	..	..	..	..	..	0·2376	0·3686	0·3780	0·4123	0·6197
Calorific power, water as vapour at 10° C. and 760 mm.	304·5	305·0	306·5	307·6	326·2	336·6	343·1	371·9	378·4	404·7	437·0	454·0	456·0	517·5	567·6	660·1	373·0	546·7	553·8	604·9	828·9
B.Th.U. per cubic foot	2023	2031	2025	2028	2023	2022	1986	2002	2004	2005	2013	1976	1976	1976	2001	1993	1958	1946	1943	1953	1978
Theoretical flame temperature. Degrees Cent. . . .	2·34	2·30	2·26	2·27	2·47	2·65	2·98	3·12	3·10	3·38	3·67	4·08	4·08	4·67	5·09	6·11	3·48	5·16	5·27	5·65	7·92
Volumes of air required for complete combustion of one volume of gas	2·10	2·06	2·11	2·12	2·22	2·38	2·51	2·68	2·85	2·94	3·35	3·54	3·38	4·01	4·39	5·37	2·93	4·57	4·52	4·92	7·16
Conditions affording the specific illuminating duty in the incandescent burner—																					
Rate of consumption (G), cubic feet per hour . .	8·98	9·04	9·50	8·33	9·40	8·30	8·10	7·49	7·00	7·20	6·22	6·40	6·34	5·86	4·94	4·64	7·88	5·74	5·23	5·23	3·67
Absolute intensity (I), candles	158·6	163·7	186·5	151·7	185·9	164·2	161·9	155·1	155·0	163·1	168·9	147·1	147·2	161·6	164·2	172·9	166·1	155·2	147·8	163·1	174·7
Volumes of air per volume of gas $\left(\frac{A}{G}\right)$	2·10	2·06	2·11	2·12	2·22	2·38	2·51	2·68	2·85	2·94	3·35	3·54	3·38	4·01	4·39	5·37	2·93	4·57	4·52	4·92	7·16
,, ,, as percentage of theoretical volume for complete combustion	89·7	89·6	93·4	93·4	89·7	89·6	84·2	85·8	91·9	87·0	91·3	86·7	80·9	85·9	86·2	87·9	84·2	88·5	85·8	87·1	90·4
Specific illuminating duty $\left(\frac{I}{G}\right)$ candles per cubic foot .	17·92	18·09	19·61	18·23	19·78	19·78	19·05	20·70	22·11	22·62	27·30	23·10	23·20	27·54	33·17	37·20	21·04	27·00	28·22	32·00	47·52
,, ,, B.Th.U. per candle . . .	17·23	16·44	15·62	16·87	16·49	17·01	17·18	17·96	17·11	17·89	16·09	19·64	19·65	18·78	17·10	17·73	17·71	20·23	19·61	19·39	17·43

If the values obtained are ranged in groups, and stated in percentages of the corresponding value for neat water gas, the following comparative figures are obtained:—

—	Calorific Power.	Specific Illuminating Duty per Volume of Gas.
Water gas	100·0	100 0
Mixtures 1, 2, and 3	109·8	106·5
,, 4 and 5 and coal gas *e*	122·6	119·4
,, 6, 7, 8, and 9	140·7	131·5
,, 10 and 11 and coal gases *f*, *g*, and *h*	181·9	161·4
,, 12 and cannel gas *j*	243·0	216·0

It will be seen that while the specific illuminating duty in incandescent burners per volume of gas does not vary in exact proportion to the calorific power, yet it varies in the same sense. While the calorific power increases from 1 to 2·43, the specific illuminating duty increases from 1 to 2·16. The duty per unit volume of gas is not quite proportional to the heat of combustion, because the illuminating duty per unit of heat is not quite constant, but diminishes as the proportion of coal gas increases relatively to the water gas in the mixtures. The chief reason for this diminution is probably a corresponding reduction in the theoretical flame temperature. If the figures given in Table V. are rearranged according to the flame temperatures, we get the following grouping:—

—	Flame Temperature.	Specific Illuminating Duty per Unit of Heat.
Water gas	2024° C.	100·0
Mixtures 1, 2, 4, 5, 6, 7, and 11	2010 ,,	96·3
,, 3 and 12, and cannel gas *j*	1986 ,,	61·6
,, 8, 9, and 10, and coal gases *e*, *f*, *g*, and *h*	1961 ,,	88·7

If, further, only the neat or unmixed gases are considered, the following striking table is obtained from the figures quoted in Table V. and others relating to similar samples:—

	Calorific Power B.Th.U. per Cubic Foot.	Theoretical Flame Temperature °C.	Specific Illuminating Duty.		Vols of Air per Vol. of Gas.	Absolute Intensity. Candles.
			Candles per Cubic Foot.	B.Th.U. per Candle.		
Water gas (average)	305	2025	17·95	16·97	2·097	160·8
Very poor coal gas	373	1958	21·04	17·71	2·927	166·0
Poor coal gas	550	1945	27·60	19·93	4·547	151·4
Rich coal gas	603	1953	32·00	18·86	4·953	163·5
Very rich cannel gas	828	1978	47·52	17·43	7·164	174·7

Water Gas Carburetted by Benzol.—The investigation was next extended to water gas carburetted with benzol; and the results of the testings made with such gas may be studied separately. They are shown in the following table (Table VI.):—

TABLE VI.

—	Uncarburetted Water Gas.	Water Gas Carburetted by	
		50 oz. Benzol per 1000 Cubic Feet.	100 oz. Benzol per 1000 Cubic Feet.
Theoretical flame temperature, degs. C.	2023	2033	2044
Calorific power, water as vapour, at 10° C. and 760 mm., calories per cubic metre	2711	3086	3468
Calorific power, B.Th.U. per cubic foot	304	346	389
Volumes of air for complete combustion of one volume of gas	2·34	2·73	3·12
Conditions affording the specific illuminating duty in the incandescent burner—viz.,			
Rate of consumption (G), cub. ft. per hour	8·79	7·44	6·76
Absolute intensity (I), candles	146·2	144·5	146·4
Vols. of air per vol. of gas $\left(\frac{A}{G}\right)$	2·02	2·44	2·77
Do. do. percentage of air required for complete combustion	86·5	89·3	88·5
Specific illuminating duty $\left(\frac{I}{G}\right)$, candles per cubic foot	16·61	19·45	21·62
Specific illuminating duty, B.Th.U. per candle	18·31	17·83	17·99

It will be seen from this that the illuminating duty obtainable from a unit volume of gas increases in rather greater proportion than the calorific power, and that, consequently, the heat units required to afford one candle decrease slightly as the proportion of benzol in the gas increases. This is not surprising, because, unlike the previous cases of coal-gas mixtures, the flame temperature rises as the proportion of water gas in the mixture diminishes. The flame temperature of benzene vapour is very high (some 2089° C.), and benzol thus increases the temperature of the water-gas flame, whereas coal gas reduces it.

Review of all the Tables.—It may be laid down in conclusion that the illuminating duty per volume of gas varies in proportion to the calorific power, except for a slight elevation or depression depending on the theoretical flame temperature of the gas—that is to say, for all gases having a calorific power ranging up to $2\frac{3}{4}$ times that of the poorest gas, the illuminating duty obtainable from a given number of units of heat is practically constant, as the deviation of its extreme variations does not exceed 15 per cent.

Minor Part Played by the Flame-Temperature of the Gas.—The author considers it is not surprising that the flame temperature has not a more marked effect on the illuminating duty obtainable from incandescent mantles. In the first place, the theoretical flame temperature is calculated on the assumption that combustion is complete; but, whatever may be the reason, it is a fact that combustion is always incomplete in the case of maximum duty. Further, the true limit of temperature of the flame is lower than that calculated; but it may be assumed to follow the variations of the latter. The most interesting point, however, is that the light of the mantle and the absolute intensity corresponding with the maximum illuminating duty are not determined by the temperature which the flame in which the mantle is inserted can attain, but by the temperature which that flame actually has and retains indefinitely. Now the temperature of the mantle in the case of maximum duty remains far below the limit of the flame temperature; for by increasing the consumption of gas the light of the mantle can be considerably increased. An instance may be quoted in illustration of this. The results shown in Table VII. were obtained with a "Bébé" mantle, Brand A No. 3, by gradually increasing the rate of consumption while always furnishing a supply of air under the best conditions. The gas used was comparatively poor—viz., having a calorific power of 535 B.Th.U. per cubic foot, and an illuminating power such that 4·8 cubic feet of gas per hour were required to furnish a light of one carcel (9·8 candles) in the Bengel burner.

TABLE VII.

No. of Test.	Consumption.	Vols. of Air per Vol. of Gas.	Absolute Intensity.	Duty.
	Cubic Feet per Hour.		Candles.	Candles per Cubic Foot.
I.	1·69	2·29	24·6	14·48
II.	3·18	3·85	69·9	21·98
III.	4·50	4·47	119·6	26·52 *
IV.	5·67	4·33	150 8	26·58 *
V.	7·05	4·24	177·7	25·22
VI.	7·81	4·42	191·4	24·50
VII.	9 86	4·38	227·7	23·08
VIII.	11·28	4·46	244·9	21·70

* Conditions of the maximum or specific illuminating duty.

It will be noticed that the maximum illuminating duty occurs with an intensity of about 150 candles; while with the same gas it is quite possible to attain an intensity of 245 candles. It is evident that in the latter case the temperature of the mantle is much higher than in the former. Thus, under the conditions of maximum duty, the temperature of the mantle is far from attaining the actual theoretical temperature, and, consequently, the calculated flame temperature for the gas used. It will therefore be understood that the variations of flame temperature will only exercise a limited effect on the duty. It is clear that if it had been decided to define the specific illuminating duty as the duty obtained when the mantle attains its highest intensity, irrespective of the consumption of gas, the theoretical flame temperature would play a more important part in the variations of duty. But such a definition would be quite irrational. The object is to settle the comparative commercial value of the different gases; and on this basis the specific illuminating duty ought to be that which affords the maximum light for the lowest consumption.

CONCLUSIONS (of the Second Memorandum).

I.—The author is of opinion that the illuminating power in the incandescent burner, or illuminating duty of a gas, expressed in candles per cubic foot (or equivalent terms) can be defined only in this manner—viz.: The illuminating duty is the maximum value of the quotient of the absolute intensity divided by the consumption $\left(\text{or } \frac{I}{G}\right)$ when a particular chosen mantle is used. When this value is divided by the calorific power (C) of the gas, the value obtained $\left(\text{viz., } \frac{I}{G \times C}\right)$ represents the duty in terms of the heat expended. [In this translation this duty has been stated, in order to obtain numbers greater than unity, as the reciprocal of the above expression—viz., in terms of the number of B.Th.U. expended in yielding one candle.]

II.—It is established that the duty obtained for the expenditure of a given number of units of heat per hour remains constant within 15 per cent. throughout the whole range of illuminating gases from neat water gas to rich cannel gas. The slight variations to which this duty is subject appear connected with the corresponding variations in the flame temperature of the gases. As a corollary, it may be stated that the duty per cubic foot of

gas consumed is very nearly proportional to the calorific power, being subject only to unimportant variations due to the effect of the flame temperature. To fix ideas on the matter, some figures obtained with "Bébé" mantles may be quoted. The duty ranges from an expenditure of 17·6 to 20·2 B.Th.U. per candle. For mixtures of a particular coal gas with water gas, it increases within these limits with increase in the proportion of water gas. The duty per cubic foot of gas consumed varies from 18 candles for neat water gas of 303 B.Th.U. per cubic foot to 47½ candles for a cannel gas of 830 B.Th.U. per cubic foot.

III.—Under these conditions, from the practical and industrial standpoint, it must be granted that the specific or normal illuminating duty in the incandescent burner is proportional to the calorific power of the gas, and the story of the preponderating part played by the flame temperature must no longer be allowed to circulate.

[This brings the author's second memorandum to a conclusion.]

(To be continued.)

SOME NEW APPARATUS FOR CONTROLLING THE MANUFACTURE OF WATER GAS.

In the following lines we give a nearly full translation of an article written by Professor H. Strache, of Vienna, in which the author describes some new apparatus he has devised to enable the process of water-gas manufacture to be controlled more accurately than has hitherto been possible.

Up to the present time there have existed no means whereby the mechanism of the decompositions proceeding within a water-gas generator, the temperature prevailing at different parts of it, and the proportion of steam decomposed, could be continuously ascertained on a large scale. The rules for working a generator generally specify a certain pressure for the air, a certain pressure for the gas inside the apparatus, and a certain time for the "blow" and for the "run." Manifestly, however, according to the resistance offered by the column of fuel to the air, the steam, and the gas, the results of working on these lines must always vary. Hence the water-gas manufacturer should particularly desire to know the temperature in the producer at every moment, and the completeness with which the steam is being decomposed. The small inspection flame often used for the latter purpose is a very imperfect guide, for it really only gives a visible indication when more than 50 per cent. of the steam introduced remains undissociated.

When a producer is being blown, the more carbon dioxide is produced—that is to say, the more perfect is the combustion—the lower the temperature prevailing. In other words, the efficiency of the blow is only high as long as the temperature of the producer is low. The efficiency of the run, on the other hand, depends upon the completeness with which the steam is decomposed; and since this decomposition is the more complete the higher the temperature of the generator, the efficiency during the run increases with rising temperature. The combined efficiency of the blow and of the run is, of course, zero whenever the efficiency of either the run or the blow is zero. Between these two points, the total efficiency of the gas-making process follows a curve whose maximum is attained when the mean temperature of the fuel within the generator lies between 750° and 900° C. When working at such temperatures, the generator gas invariably contains some carbon monoxide as well as carbon dioxide; but if the product is employed for superheating steam, or for heating the fixing chambers in the oil-carburetting process, its presence is of no importance.

The earliest form of apparatus designed by Dr. Strache for controlling the speed of the steam and of the gas is shown in fig. 1. The pipe K, admitting steam to the generator, is fitted with a valve N, and then with a constriction E. From spots before and after the constriction, tubes lead to the two limbs of the pressure-gauge D, which is filled with mercury and which, therefore, shows the difference in pressure obtaining before and after the constriction. Thus the position of the mercury in the "steam" pressure-gauge is a measure of the velocity at which the steam is travelling; whereas the velocity in question can be controlled by means of the cock N. On leaving the generator, the water gas passes to a scrubber where the undecomposed steam is precipitated. The outlet of the scrubber is provided with a second constriction L, which produces the greater difference in pressure in the gas-main before and after it, the greater the amount of gas forced through it. The difference in pressure brought about by the second constriction is indicated in the manner described, by the difference in level in the two limbs of the "gas" pressure gauge M, which is filled with water.

The two pressure-gauges are erected side by side, and, by selecting suitable diameters for the two constrictions, the levels of the two liquids in the gauges can be so arranged as to occupy similar positions upon the scale H when the steam is being completely decomposed—that is to say when two volumes of water gas are being produced from each volume of steam. In these conditions, if any steam escapes dissociation the fact is at once evident, inasmuch as the gas-pressure gauge indicates a smaller difference in level than the steam-pressure gauge. To give an example, if for every volume of steam only 0·7 volume is decomposed and 0·3 volume remains as such, 1·4 volumes of water gas are produced, which, together with the 0·3 volume of undecomposed steam, yield 1·7 volumes of hot gas. Of these 1·7 volumes, 0·3 volume—*i.e.*, 17·5 per cent. is undecomposed steam. Since the two gauges stand at the same level when one volume of steam yields two volumes of gas, since in the example under consideration only 1·4 volumes of gas are passing through the constriction in the gasway, and since the differences in pressure vary as the squares of the volumes compressed, the difference in level indicated by the gas-pressure gauge must be as $2^2 : 1{\cdot}42^2$—*i.e.*, as 4 : 2. That is to say, the displacement of the liquid in the gas-pressure gauge when 17·5 per cent. of the steam eludes decomposition is only half what it is when the whole of the steam is dissociated. The defect of this apparatus is that it leaves too much to the gas maker, who may observe the pressure-gauges somewhat carelessly and may not shut the steam-valve at the right time.

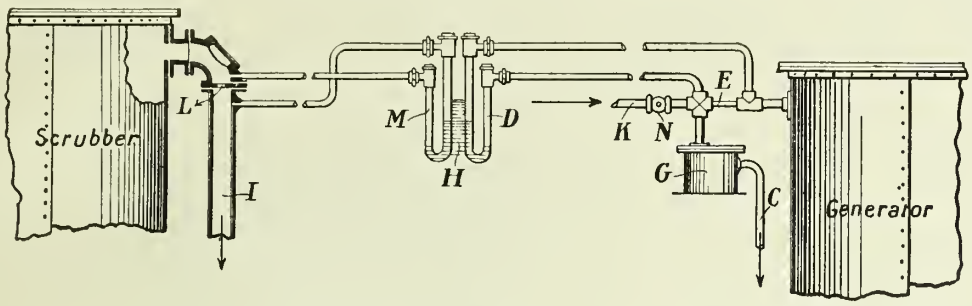
The latter defect is eliminated in the new apparatus—known as a "Dampfschlussmelder" or steam-controller—which is shown in fig. 2, where the letters mostly refer to the same parts as in fig. 1. The steam pressure is maintained at a constant point by means of a governor F; and its value is read off on the manometer M. The velocity of the steam is controlled by means of the constriction K. The gas current is throttled at a point L as near as possible to the holder, where the water gas is stored under constant pressure; and therefore the pressure before L is a measure of the velocity of the gas. The narrow tube A leads through the open cock *a* to the small holder *h*, in which floats a bell that can be loaded as necessary—the cock on the outlet tube *c* being closed. If now, the volume of gas made per unit of time falls below the predetermined minimum, the pressure drops, and the bell *h* falls and causes an electrical alarm to sound. In this manner the gas maker is notified that the steam valve requires closing. The apparatus marked T is the device brought out some time ago by Dr. Strache under the name of the "Autolysator" which serves for the continuous estimation of the carbon dioxide in the gas. At a point after the constriction L, the tube B terminating in the cock *b* leads the water gas to the autolysator T; and the proportion of carbon dioxide in it is recorded automatically on the drum R. The autolysator can also be employed for ascertaining the proportion of carbon dioxide in the producer gas; the cocks *a* and *b* being closed, and the cock *c* on the pipe C (which enters the upper part of the producer at G) being opened.

With the aid of the above-described apparatus the process of water-gas manufacture is carried out as follows: The steam regulator is set so as to give a pressure suitable for the rate at which gas is to be made. The velocity of the steam is caused to be the greater the more gas is to be produced per unit of time. But, as it is not desirable that the temperature in the generator should be kept so high that no undecomposed steam is present even at the end of the run, the bell of the steam-controller is loaded rather less than would correspond with complete dissociation. The gas maker is instructed to open the steam-valve, and see if the steam-pressure gauge shows the right pressure, which is maintained at a constant height throughout the whole of the run. If the temperature in the generator is high enough, the bell of the steam-controller continues to rise from the moment the steam begins to be completely decomposed. Should it not rise, the generator temperature is too low; and the run must be interrupted, and the fuel blown up to a higher temperature.

During the run, the temperature of the generator falls; the proportion of the total steam dissociated decreases; and therefore the pressure before the constriction on the gas-main diminishes. The gas maker is also instructed to stop the run as soon as the electric bell rings. In this way, when the velocity of the steam remains constant, the run is always stopped as soon as the proportion of steam decomposed falls to a certain point. But since the proportion of steam decomposed accurately corresponds with a certain average temperature in the generator and *vice versâ*, the temperature at which the run is interrupted is governed precisely by the steam pressure-gauge and the weight on the steam-controller. Even if different quantities of air are introduced during the blow, and the temperature in the generator at the end of the process is thereby caused to differ, the action of the steam-controller always brings the temperature down to a specified point at the end of the run. But, of course, the volume of gas that is obtained during the run is the greater the higher the temperature attained during the blow. By decreasing the velocity of the gas at the moment when the run is stopped, it is possible to reduce the temperature in the generator; and by increasing the velocity—*i.e.*, by loading the steam-controller—it is possible to raise the temperature. On the other hand, when the steam-controller is loaded with a constant weight, increase of velocity in the steam reduces the temperature in the generator and *vice versâ*.

The proportion of carbon dioxide in the water gas depends on the completeness with which the steam is decomposed; and, therefore, by suitably adjusting the steam-controller, the proportion can be set at the desired point. This is particularly advantageous when the water gas is to be used for industrial purposes (such as welding), for the carbon dioxide seriously reduces the temperature of the flame. With the aid of the steam-controller a good yield of water gas can be obtained, containing even less than 1 per cent. of carbon dioxide.

It should be understood that the steam-controller only governs the mean temperature of those parts of the generator where the steam is being dissociated. The temperature of the upper layers



C Outlet for condensed water.
D Steam pressure-gauge.
E Constriction in steam-pipe.
G Water trap.
H Scale.
I Gas-main.
K Steam-inlet.
L Constriction in gas-main.
M Gas pressure-gauge.
N Steam valve.

Fig. 1.—Strache's Pressure-Gauges for Controlling the Manufacture of Water Gas.

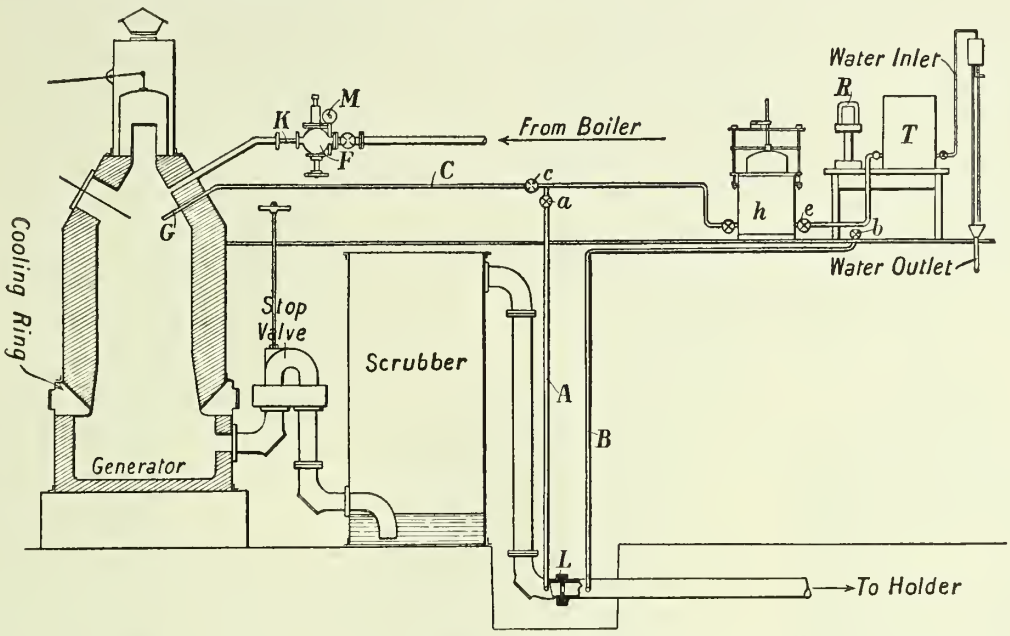


Fig. 2.—Strache's Steam-Controller and "Autolysator" for Controlling the Manufacture of Water Gas.

of fuel and also that of the generator gas depend upon the nature and duration of the blow. To observe the temperature of the generator gas, a pyrometer is put in the flue; and, if desired, the blow may be stopped as soon as it indicates any particular temperature. The temperature of the upper parts of the producer can also be regulated in a similar manner, while leaving it still possible, during the subsequent run, to keep the temperature in the lower parts of the generator at a sufficient height by interrupting the run at the proper time. Indeed with the assistance of the steam-controller and of a pyrometer in the flue, the temperature of the generator gas from plant into which the steam is always introduced from above, can be kept as low as 150° C., while the water gas ouly contains from 2 to 3 per cent. of carbon dioxide, and the steam is wholly decomposed. The autolysator serves, as already mentioned, to maintain the temperature in the lower parts of the generator at the most advantageous point. If the proportion of carbon dioxide in the geuerated gas is small, the temperature at the base of the generator is too high, and therefore the load on the controller bell should be reduced. If, on the other hand, the proportion of carbon dioxide is found to be too high, the bell must be weighted more heavily—that is to say, the run must be stopped sooner, at a higher temperature which corresponds with more complete decomposition of the steam.

Experiments with the Author's Apparatus.

Some experiments to ascertain the value of the steam-controller have been carried out in the water-gas plant of the gas-works at Königsberg, where the plant in question belongs to the Strache system and has always worked satisfactorily. After fitting the controller to one of the generators there, the following results were obtained during a twenty-day trial. It was found that: (1) At the end of each run the proportion of undecomposed steam which was formerly from 79 to 100 per cent., had fallen to from 18·4 to 25·2 per cent. (2) The proportion of carbon dioxide had fallen from 4 or 6 per cent. to 2·2 per cent. (3) The gross calorific power of the water gas at 0° C. had risen to 349 B.Th.U. per cubic foot—*i.e.*, was higher than the theoretical value (the excess being due to methane). (4) The consumption of condensing water had fallen to 25 gallons per 1000 cubic feet. (5) The capacity of the producer, which was supposed to be 8840 cubic feet, had increased to 14,450 cubic feet, and the make of gas per long ton of coke had risen from 55,500 cubic feet to 98,500 cubic feet. After a year's trial, the apparatus was also fitted to the second producer—instructions being given that an increase in the capacity of the plant was of primary importance, but that serious alterations in the design could not be allowed. Although the capacity was limited by the dimensions of the gas-main, by the maximum permissible temperature in the apparatus, and by the fact that the temperature and proportion of carbon monoxide in the producer gas must not be increased too much lest the temperature in the chimney should be excessive,* it was nevertheless found possible to increase the make to some 20,000 or 21,000 cubic feet per hour. The output could, indeed, have beeu raised still further if the chimney had been lined with firebrick and the gas-main increased in size.

Owing to the favourable results of the experiments at Königsberg, a water-gas installation was erected at Itzehoe, where it was specially desirable to obtain gas of high calorific value aud the largest possible yield from the fuel without considering the capacity of the plant per unit-time. The apparatus was brought into action at the end of 1905; and, as the result of a fortnight's trial, it was found to make from each long ton of coke 82,000 cubic feet of water gas—having a gross calorific value of 332 B.Th.U. per cubic foot—*i.e.*, to yield a gas containing 121,500 B.Th.U. per pound of coke, equivalent to 83·6 per cent. of the calorific value of the fuel. The net calorific value of the gas was 314 B.Th.U., whereas, in view of the carbon dioxide contained, it should have been only 300 (the excess being due to the methane). The heat balance-sheet of the water-gas process over its fortnight's trial quoted in metric data and in terms of net calorific value was as follows:—

	Calories.	Per Cent.
Sensible heat of water gas and of undecomposed steam	102	2·8
Radiation	15	0·4
Loss by formation of carbon monoxide during blow	616	17 3
Sensible heat in generator gas	158	4·4
Net heat of combustion of water gas	2674	75·1
Heat of combustion of 0·439 kilo. of coke	3565	100·0

When the generator gas was used for steam-raising, the balance-sheet became as follows (gross calorific values being quoted):—

	Per Cent.
Sensible heat of water gas and of undecomposed steam	2·8
Radiation	0·4
Losses of heat in chimney gases and from boiler	13·2
Gross heat of combustion of one cubic metre of water gas	83·6
	100·0

A similar installation for the manufacture of non-carburetted water-gas has been erected at Pirano, which yields a water gas containing only between 1 and 2 per ceut. of carbon dioxide. The illuminating power of the incandescent lights employed has thereby been increased by more than 20 per cent. Indeed, the incandescent burners run on water gas give more light per unit consumption than those that are supplied with true coal gas.

* The Königsberg generators were so designed as to be run alternately from above and below, and therefore exhibited a high temperature in their generator gas.

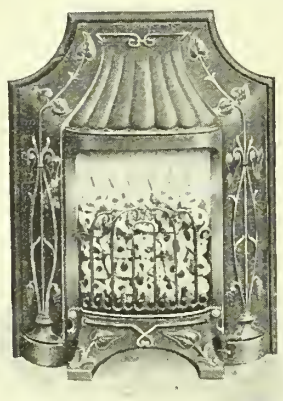
NOVELTIES FOR THE HEATING AND LIGHTING SEASON.

IN THE GAS-HEATING SECTION.

(*Continued from p.* 761.)

Fletcher, Russell, and Co., Limited.

To attempt to describe the extensive variety of gas-fires of a firm of such reputation and standing as Messrs. Fletcher, Russell, and Co., Limited, in a short notice would be to attempt an impossible task. Therefore, we shall confine ourselves to a brief notice of a few of the principal patterns produced specially for the coming season. There has sprung up a demand, and we are not surprised that it should be so, for gas-fires of more attractive exterior than those of a few years since—something of less ponderous appearance, and something that through the eye would give pleasure. It must not be forgotten that a gas-fire, when not in use, has not its radiance and comfortable warmth to sustain it in favour; and therefore a good external appearance is necessary to prevent it becoming an abomination in the eyes of its possessor, and voted a disgrace to its surroundings. Such will not be the case with the new patterns of Messrs. Fletcher, Russell, and Co. Whether we take the "Nubian," the "Rustie," the "Ornate," the "Syrian," or the "Palmyra" fires as examples, our judgment applies. In the "Nubian," we have a production specially designed with the view of meeting the demand for a cheap and yet tastefully cased fire, combining with those attributes efficiency and economy. Finished in the various coloured majolica enamels, the ornamentation is greatly enhanced. It is a fire with a 10-inch wide opening; and it occupies little space in front of the ordinary grate, being only $5\frac{1}{2}$ inches back to front. It is fitted with a patent non-lighting-back burner, and is most economical, being adjusted to consume only 15 cubic feet of gas at 1-inch pressure. The "Rustic" gas-fire is really a complete departure from ordinary lines; and there is originality in its design which will gain for it wide approval. The ornamentation is all in relief; and it takes the form entirely of rustic work. It is indeed a very effective fire. Like all its new companions, it is fitted with a non-lighting-back burner, has a 10-inch fire opening, and measures 7 inches back to front. But for exquisite design, the "Ornate" fire will require some beating. The ornament is in bold relief from a plain ground; and while it looks graceful in ordinary stove enamel, in coloured majolica enamel it will gain admiration in the choicest appointed rooms. This fire also has a 10-inch opening, and is $7\frac{1}{2}$ inches back to front. The "Syrian" fire is one that will be found particularly useful for bed-rooms, nurseries, &c., where a heated flat top, with boiling-ring, is required. The fire opening is here also 10 inches; and the fire measures from back to front $6\frac{1}{2}$ inches. The "Palmyra" gas-fire is similar in design to an ordinary coal register stove. The ornament is chaste and rich; being in the Adam style. It is a handsome piece of work, and is made, apart from the ordinary finishes, in bright brass or copper, or antique copper repoussé casings. It is constructed to suit 36-inch and 38-inch registers. The firm make a speciality of mantels for gas-



The "Nubian" Fire.

The "Rustic" Fire.

The "Arran" Stove.

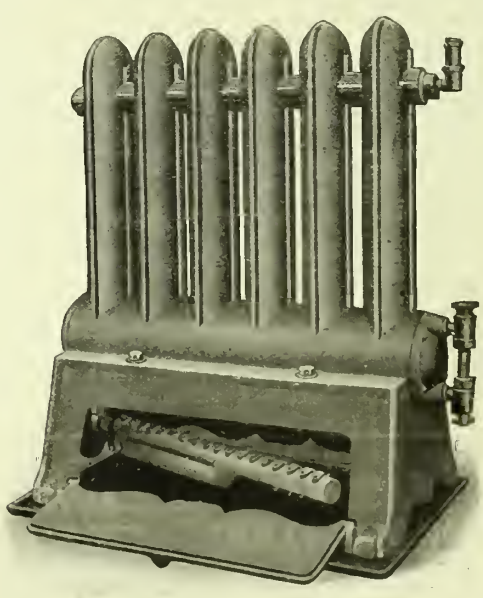
fires; and this "Palmyra" fire set in one of these mantels, also with Adam ornamentation, must be pronounced a really beautiful combination.

In the "Cathedral" series of heating-stoves (which are intended for entrance halls, shops, offices, warehouses, and well-ventilated rooms), we have an improvement on the firm's well-known "Ruby" series. The firm describe them as giving "a brilliant and pleasing effect;" and the description is not an overstatement. This effect is obtained by the combination of overlays of ruby and embossed glass, and the heating power is greatly enhanced by a number of hot-air tubes, which are placed round the burners, and to which special study has been given so as to obtain the best possible results. They are elegant in design, and therefore applicable to all situations in which such heaters can be used. The "Asia," the "Granada," the "Alhambra," the "Arran" (as illustrated) and the "Canadian" stoves in this series give a range in variety that will gratify all tastes.

Cannon Iron Foundries, Limited.

The Cannon Iron Foundries have sent us a copy of their new season fire-list entitled on the outside cover "The A. B. C. of Buying Gas-Fires;" and these first letters of the alphabet naturally imply "Always Buy Cannon." It is an attractive list, consisting of 24 pages, and is very convenient for pocket or counter use. The list contains a variety of gas-heating stoves of various descriptions, from an artistically designed steam-radiator to a small corridor stove, embracing quite an extensive range of the ordinary ball-fuel type of gas-fires.

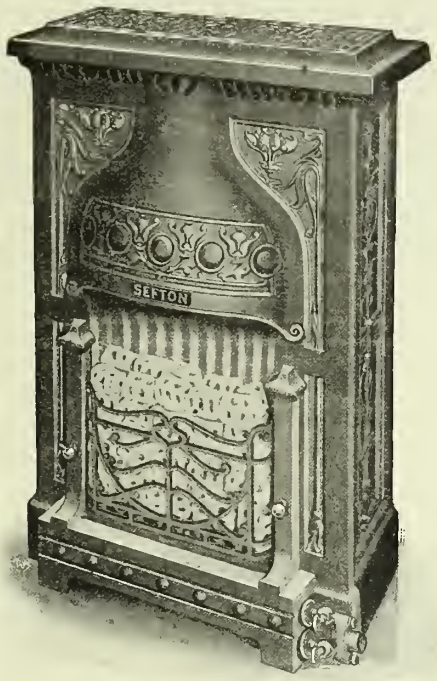
Special attention is directed to a few distinctly new lines the firm have introduced this season. In the first place, we have a new series of steam and hot-water radiators of plain design, to afford customers the choice of the plain or ornamental series. The ornamental series, we are informed, has been in considerable demand; and it may be of interest to mention that this type of heater has been recently selected for use in the Queen's Rooms at Glasgow. Then there is a special type of radiator, called the "Radio," which is on distinctly fresh lines; affording as it does a radiator possessing all the essential features for the highest efficiency at a low price. One of its special features is that the loops and boiler are cast in one piece, which avoids the possibility of leaky joints. This feature is covered by a patent. The Company's "Sefton" and "Savoy" fires are of a very choice design; and they are fitted with an improved duplex burner, and with air and gas regulator to each section. A new type of gas-fire, with all modern improvements, is called the "Magic;" and the same



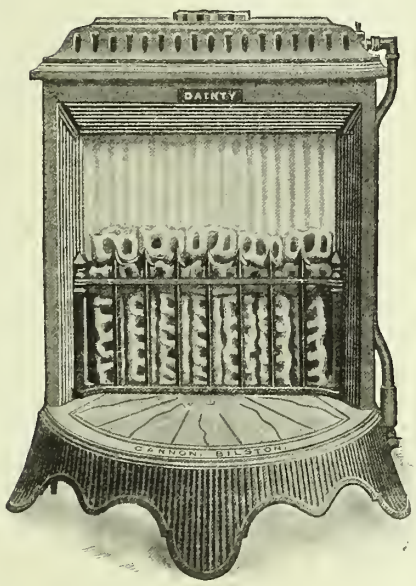
The "Radio" Gas-Heated Steam Radiator.

fire, adapted with boiling-burner arrangement on top for nursery use, has been named the "Dainty." These fires are most up-to-date, and are fitted with air and gas regulators. It is interesting to note in the list an extract from the "Lancet," showing the unique position attained by the "Cannon" gas-fires in the Smoke

Abatement Society's test carried out during last year. The firm have also issued another pamphlet entitled "Modern Bakeries Gas Fuel." This treats of gas-ovens constructed on improved principles, as supplied largely to bakers and confectioners. The



The "Sefton" Gas-Fire.



The "Dainty" Gas-Fire.

list contains a few printed testimonials, showing the undoubted serviceability of the ovens. In the same list is included a pikelet or muffin plate as an article of utility in the same line of business.

Coking Coals.—In the course of his address at the Pittsburg meeting of the Coal Mining Institute of America, the President dealt with the subject of coking coals. He said a careful study of the facts led him to believe that the reasons for some coals coking or submitting themselves naturally and readily to the coking process and furnishing a high-grade coke were as follows: (1) They are in structure largely prismoidal, permitting the free mixing of the particles, diffusion of gases, &c. (2) Their chemical composition is such that they contain not only the fusing and cementing factors in the most favourable proportions, but carry the most desirable elements in those proportions, and the form best adapted to the purpose for which the coke is required. He thought the reasons some coals were not naturally fitted for the coking process, but yielded high-grade coke after disintegration, were these: (1) Their structure is largely of a laminated character; thus presenting obstacles to the free mixing of the particles and diffusion of gases. (2) Their chemical composition is not widely different from those of the natural coking coals; but they cannot adjust themselves to the necessary processes of fusion, cementation, and interchange of position of the different elements that the complete coking process requires, unless the coal has first been disintegrated or pulverized.

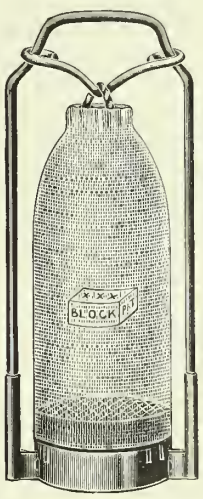
IN THE LIGHTING SECTION.

(*Continued from p.* 769.)

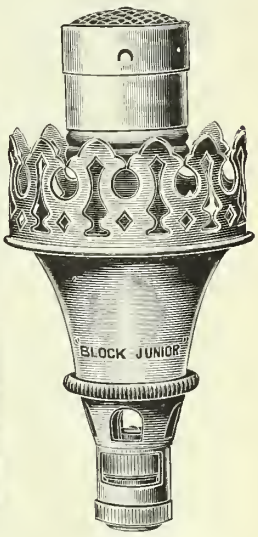
Block Light, Limited.

For the coming season we witness a great extension of the enterprise of Block Light, Limited. In the first place, they show us a variety of literature designed to spread light on light, and then they tell us of their business expansions, both in method and goods. The Company's burners, as is well known, are made in two sizes, called the "Standard Block" light and the "Junior Block" light. The high duty of these burners for the consumption of gas, it is pointed out, is due to the scientific construction of every part of the burner itself and the make of the mantle.

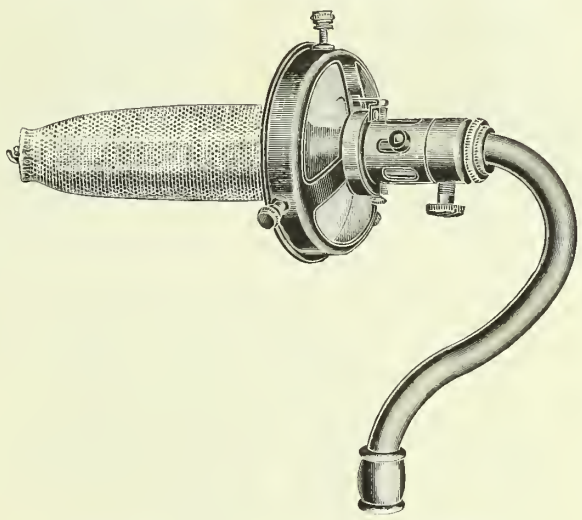
The Block Standard Burner.



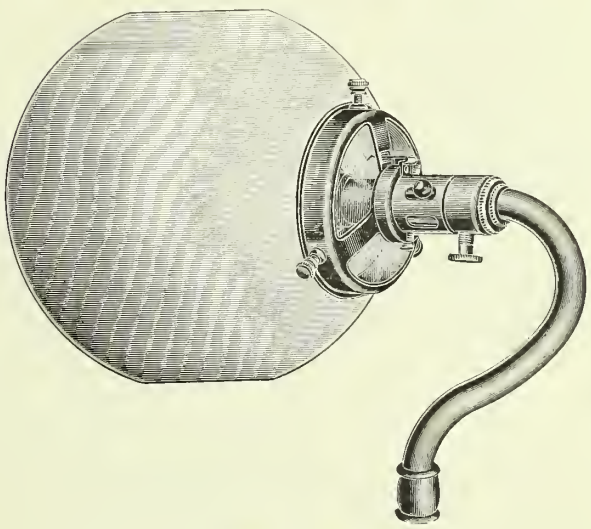
Anti-Vibro Mantle.



The Block Junior Burner.



"Horizon" Economy Light (Shade Removed).



"Horizon" Economy Light (Complete).

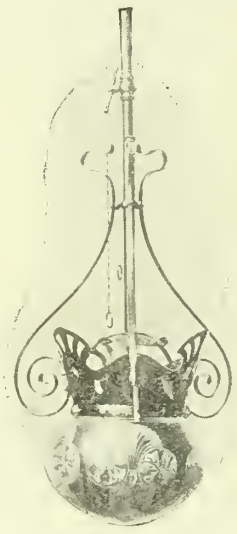
Several new combinations of the burners and glassware have been introduced for this season; and they are very effective. Opal shades coloured tipped at the edges are both useful and ornamental; while combinations with coloured globes of artistic design fit the burners for all positions. The "Junior Block" light

has undergone changes in outer form to constitute it suitable in every way for the most daintily appointed apartment; and the special glassware for it is also highly ornate. The "Block" mantles are now British made with British labour; and a fresh extension of the Company's enterprise is the packing in a sealed box of one of their burners and a Block "Anti-Vibro" mantle (made with a wire supporting frame and gauze inside the mantle instead of on the burner top, so that the gauze is renewed with every mantle), with a three months' guarantee for the mantle. The Company are also making a mantle to fit any burner, under the title of the "Block Economy Anti-Vibro" mantle. A novelty is the "Horizon Economy" light. The illustrations best describe it. It is made with simple regulation of gas and air; and any ordinary looped mantle can be used with it. The illuminating power of the light is stated to be 150 candles. The Company have branched out into the mantle supply business for all vertical and inverted burners, glassware, and attractive silk and lace and bead shades.

G. Hands and Co.

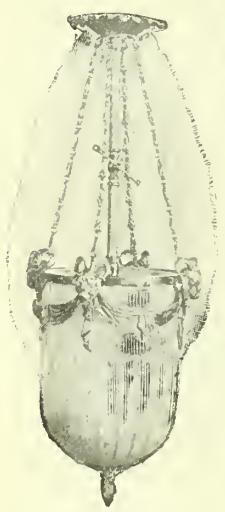
The gas-fittings of a room may make or mar it; and we venture without hesitation to say that the "Modern Art" gas-fittings of Messrs. G. Hands and Co. will add to the refinement and decoration of any room or other position in which they are placed. Their fittings must be seen to be properly appreciated; for they have brought the art of gas-fitting making up to a high pitch of perfection. Gas-fittings may be strong and their finish irreproachable; but when to these merits there is added novelty in design and comprehension of artistic requirement, then we have something which appeals to us as worthy of commendation and acceptation. All this may be said, without qualification of any kind, of the fittings under notice. Our illustrations are merely specimens of a great and charming variety, specially designed for every conceivable situation, which are to be seen at the firm's showrooms in Farringdon Road. Mostly the fittings, whether pendants or brackets, are hand beaten and finished in oxidized copper, and some of them have aluminium insertions which add to their beauty. Particular attention is drawn to the firm's patent bazils (introduced into pendants and brackets), in which family photographs, views, or armorial bearings can be placed. Not only in the metal work but in the glassware of these fittings is art brought into play; for the glassware is made to match the fittings. Pleasing indeed are the designs in opalescent glass, satin-finished etched glass, or etched and tinted glass. The French brackets, finished in gilt, also take the fancy as drawing-room fittings. The growth of the desire for more light has been accompanied by a desire for the displacement of the old plain and heavy fittings by something lighter and more ornate. Here wants may be fulfilled without disappointment.

The "Regina" Pendant.



The "Metropole" Pendant.

The "Jersey" Bijou Bracket.



The "Ritz" French Gilt Adam Lamp.

The "Henley" Bijou Bracket.

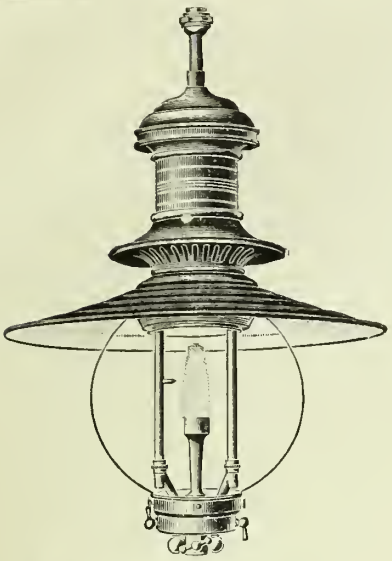
What is known as the "Norwich" system of gas lighting has also been introduced by Messrs. Hands and Co. In its invention, Mr. Thomas Glover, Engineer and Manager of the British Gaslight Company's Norwich Station, and Mr. W. H. Wayte, the District Superintendent, were jointly concerned with Mr. Hands. It was always accounted a convenience peculiar to electric lighting that it could be switched on and off at the will of the user without trouble, matches, or taper. That convenience is not now peculiar to the electric light; for automatic arrangements for distance lighting have long been on the market, and have successfully removed the singularity of electric lighting in this respect. Appropriately, the newest method of gas lighting has been named after the place of its birth; and so is known as the "Norwich" system of gas lighting. One of its greatest recommendations is, next to its reliability, that it is the nearest approach that has yet been devised to the tumbler switch employed in electric lighting. The tumbler switch is fitted in the gas-service pipe between the meter and the fitting, at a convenient place in the room for access. In the case of a complete new installation, main pipes are laid under the ground floor, with connections rising to each switch; and a pipe is then led from the switch to the burner. By piping in this manner, any condensation is drained into the main pipe. When applying the system to existing gas-fittings, it may be necessary for a pipe to descend, and afterwards return from the switch—see "JOURNAL," Sept. 10, p. 703. In this case, it is advisable to fit a syphon (of a form provided) underneath the switch, and connected to the return pipe. Then should condensation take place, it is a very simple matter to drain the pipes. If it is not convenient to chase the pipes into the wall, they can be run in capping and casing, exactly as with electric wires. The auto-igniters are screwed on to the fittings just below the burners. The igniters are adjusted by a bye-pass screw on the tumbler switch until the pilot lights are sufficiently reduced. In the event of any of the pilot lights then being too large, they can be further regulated by a socket screw on the igniter itself. But an important point to bear in mind is that the success of the apparatus depends entirely upon the proper adjustment of the set-screw in the tumbler switch, and not upon the screw in the igniter. Not the least inviting feature of this system is that no unsightly extra tubes or wires are required.

It is not surprising to learn that already the system has attained a gratifying popularity; and many testimonials have been received. This is an example from the proprietor of the Great Eastern Hotel, Norwich (dated as late as the 12th ult.): "I have much pleasure in testifying to the success of the 'Norwich' system of gas installation as recently fixed in this hotel. I have now given it a quarter's trial, *after having the electric lighting entirely removed*, and am very pleased with the change. The unique method of switching on is a great boon." The tumbler switch is one of the best auxiliaries to incandescent gas lighting (vertical or inverted burners) that it has yet been our privilege to welcome. Messrs. Hands and Co. we believe will have a stand at the Manchester Exhibition, so that those of our North of England readers who cannot visit the show-rooms in Farringdon Road, will have an opportunity of inspecting the working of the system at Manchester.

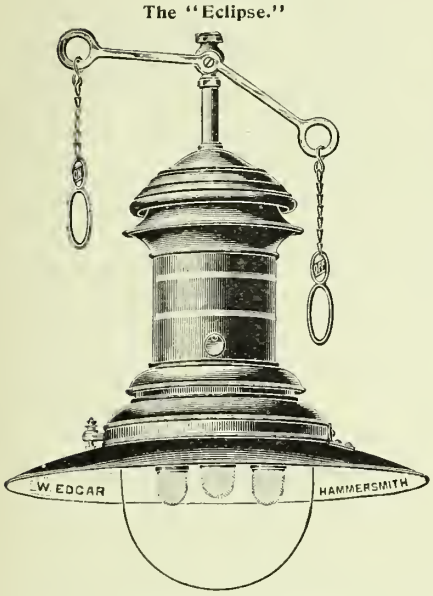
William Edgar.

The latest addition to Mr. William Edgar's apparatus and appliances for lighting is a quite recently patented plant, here illustrated, for high-pressure incandescent gas-lighting. The main feature of the invention is that any pressure can be determined. The relief-valve and tube act automatically as a bye-pass, and come into action after the predetermined pressure is arrived at. The gas is subjected to a churning over and over again. Another principal claim is that the plant is silent; and its compactness, and consequently the smallness of space occupied, cause it to be adaptable to almost any premises. It is simple in construction, and has a duplicate motion—one charge of gas being compressed, while the other is being sucked or drawn into the compressor. The burner used for this high-pressure lighting is cast brass, with a removable top portion of german silver.

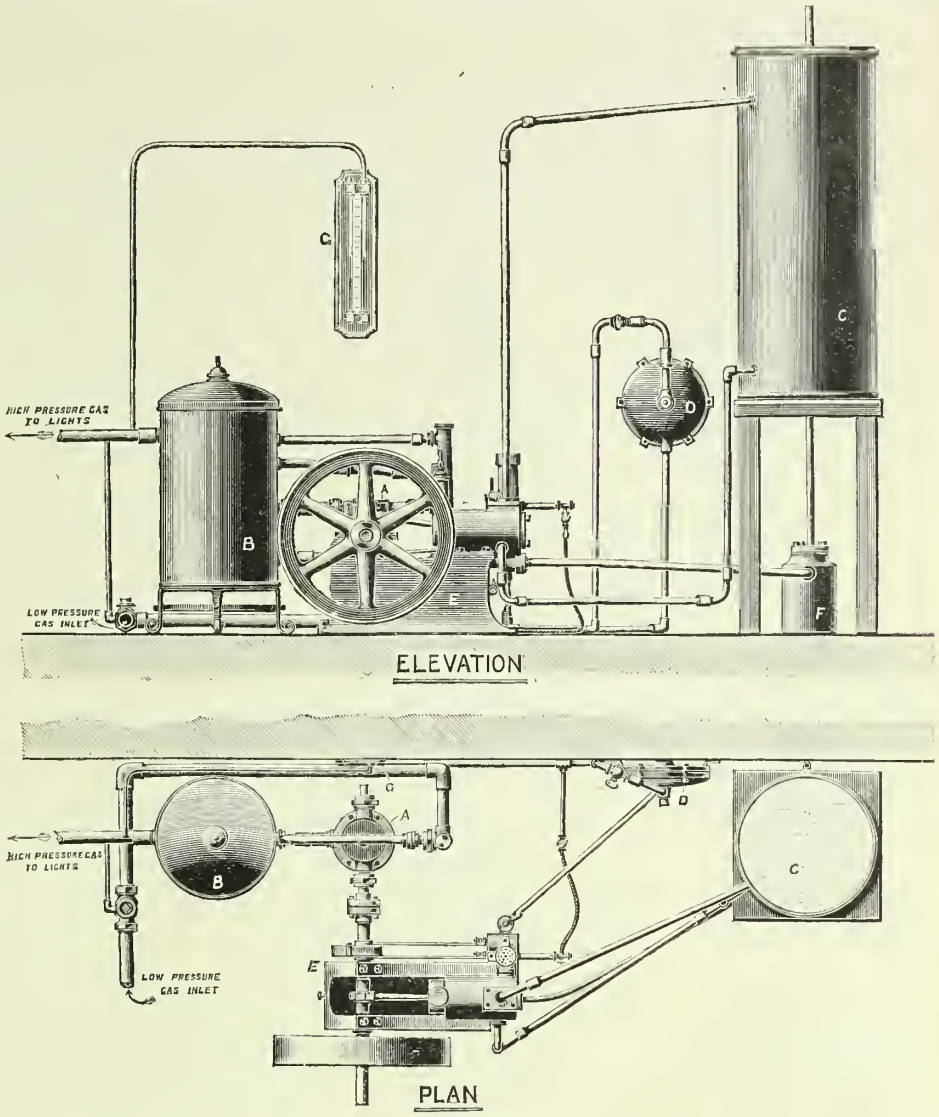
Looking round Mr. Edgar's collection of lamps suitable for every conceivable purpose, we see types that are familiar in low-pressure lighting, but which have now also been constructed for high-pressure work. We may specially mention in this connection the "Eclipse," the "International," the "Caxton," the "Imperial," and the "Mereury" (with a mercury seal anti-vibrator), all for high-



The "Eclipse."



"Eclipse" Inverted Lamp.



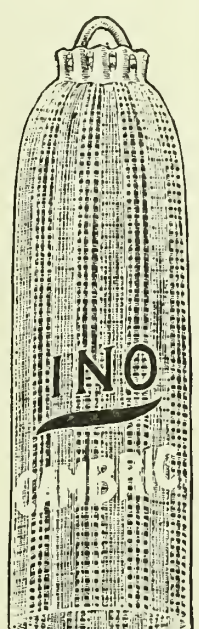
Edgar's High-Pressure Plant.

A. Pressure Raiser. B. Container and Governor. C. Water-Tank. D. Gas-Bag. E. Gas-Engine. F. Exhaust Silencer. G. Pressure-Gauge.

pressure lighting. Improvements in lamps for inverted lighting are manifested in the "King" and the "Eclipse" inverted lamps. Profiting by exhaustive experiments, both of these lamps are element-proof, non-lighting back, and impart a high rate of duty. For indoor lighting, Mr. Edgar is showing some fine effects in registered designs. Among them are the "Safety," "Idene," and "Pansy." In another department of work is a hot-water circulating apparatus for gas, which (with the recently patented seal-screw main cock) has distinctive features that the gas engineer will be interested in examining.

United Chemical Works, Limited.

The United Chemical Works, Limited, call attention to their new "Ino Cambric" mantle as their chief novelty for the coming lighting season. The mantle consists of ramie fibre; but the texture, instead of being knitted, is woven by the Company's new patent-weaving machine. The quality of the mantle is credited with being a great improvement. As is seen in the illustration, the weaving consists of a number of close vertical webs, alternating with a web of more open texture. The mantle, we are informed, is impregnated in a far heavier solution (some 50 per cent. more than formerly) of thorium nitrate; and, as all incandescent mantles depend upon this chemical solution for their illuminating power, the stronger the impregnation of the mantles the stronger the light. The new mantles have been tested by the Imperial Technical Laboratory at Charlottenburg; and it is stated that they produce a light of 130-candle power, with a consumption of $4\frac{1}{2}$ cubic feet of gas per hour.



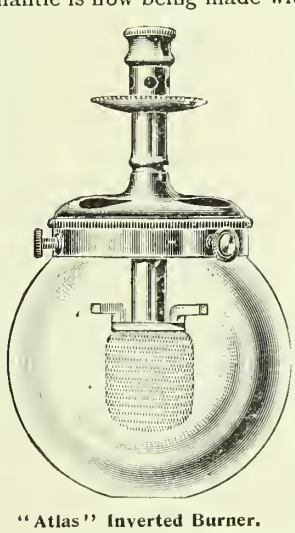
New "Ino" Mantle.

Gasgluhlicht Gesellschaft Hamburg.

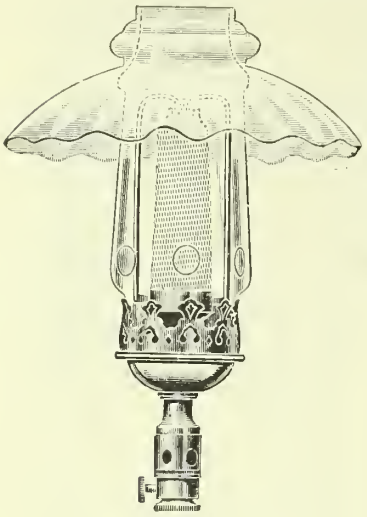
A new high-pressure mantle is brought to notice by Mr. Ludewig Kappelhoff. It is manufactured of the best ramie; and is made up by what is called Haga weaving. It is of such strong texture that, we are informed, it will stand a gas pressure of some 100 inches. Strength, durability, and brilliancy are the virtues desired in a first-class high-pressure mantle; and these are all claimed for this one. Other advantages of the mantle are that there is no shrinkage, and that the mantle maintains its brilliancy during the whole of its lifetime, which is said to be considerable. The weaving (accomplished by patented machines) is only done by the Gasglühlicht Gesellschaft Hamburg; and the mantle is offered to the trade by the sole agent in London, Mr. Ludewig Kappelhoff. All sizes of upright mantles, for coal, acetylene, and air gas, can be made by this weaving.

J. & W. B. Smith.

This firm have also incorporated several novelties in their large range of lighting goods for the winter season. Their "Glasmi" mantle is now being made with nickel supports, and in sizes to fit the Block "Standard," "Junior" or ordinary "C" burners. Among inverted burners is a neat one of the bijou size, which is named the "Atlas." It is a cheap burner, with a good efficiency. For factory use the inverted light is now reaping a large share of favour; and this is not astonishing, inasmuch as in most works a good downward light is what is required on bench, machine, or other work. Messrs. Smith are offering a new form of fitting provided with reflector, anti-vibrating device, and wire shade to the globe—making a very complete combination for workshops or factories. With old pendants, it is a source of some nuisance to the consumer that they cannot readily be converted from the bottom of the downward tube for the inverted incandescent burner, without scrapping the whole pendant. If someone will get out a series of fittings at moderate price for this purpose, we believe there would be a good demand

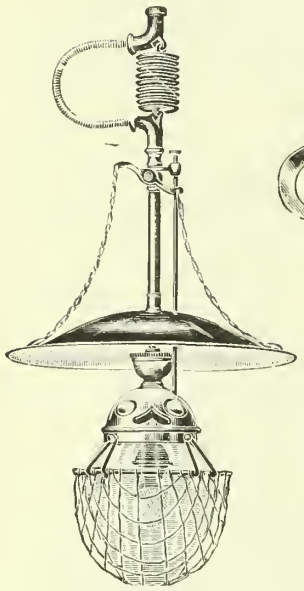


"Atlas" Inverted Burner.

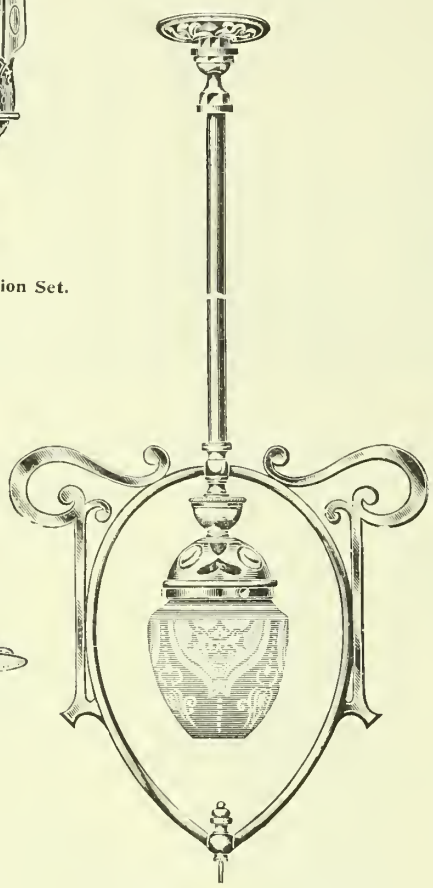


A New Combination Set.

for them. Here we have introduced a pendant which can be used either for an upright or inverted burner at will. Among other goods is noticed a new combination set, comprisiug burner, mantle opal shade, and chimney. The firm have also now extended their silk



New Factory Fitting.



New Pendant for either Vertical or Inverted Burners.

flounce and opal shades to patterns suitable for use with the inverted light.

The Yorkshire Junior Gas Association will next Saturday pay a visit to Messrs. Stainsby and Lyon's tar-works at Knottingley, by permission of Mr. J. G. Lyon.

A vitrified clay water-main, 12 inches diameter and 3 miles long, has been constructed at Hobart (Okla.), under the direction of the United States Geological Survey. It is made of double-strength pipe, and is subjected to a maximum head of 14 lbs. The joints were caulked with oakum, and run with a mixture of both pure and crude asphalt and petroleum.

An invention by Engineer-Commander Metcalfe, for quickly discharging coal from colliers, was recently tested in Portsmouth Harbour. Its chief feature consists of a grab, which, descending into the hold of the ship, picks up the coal, which, by means of an overhead railway, can be conveyed to any required place ashore, or be deposited in trucks alongside the ship.

A correspondent of the "Ironmonger" recently asked for advice as to the best method of treating a quantity of tar which he wished to make thinner. He said he was aware that this could be done by heating; but he did not wish to use the tar hot. He had tried paraffin without success. In a recent issue, his inquiry was answered by two correspondents who recommended him to use motor spirit, the effect of which would, they said, be that the tar would "dry in an hour, and look as bright as varnish."

The German papers announce the death of Herr Christian Friedrich Schweickhart, on the 7th ult. Herr Schweickhart was born at Offenbach in 1848; received his technical training in the Frankfurt works of the Imperial Continental Gas Association, but migrated to Vienna in 1868; and remained in Austria for the rest of his life. Herr Schweickhart was well known on the Continent of Europe as an inventor of gas governors and cooking stoves; as the compiler of a pocket-book for gas engineers; and as the founder of "Schweickhart's Zeitschrift für das Gas und Wasserfach"—a periodical he edited from 1895 to the day of his death. Herr Schweickhart had been a member of the German Association of Gas and Water Engineers since 1880, and was one of the chief original members of the Austro-Hungarian Association. He was also largely responsible for the introduction of coin-freed gas-meters into Vienna.

EXPERIENCES WITH GAS-ENGINE BREAKDOWNS

(*Concluded from p.* 755.)

We give to-day some further particulars from the annual report of the Chief Engineer of the British Engine, Boiler, and Electrical Insurance Company, Limited (Mr. Michael Longridge, M.A., M.Inst.C.E.), of a year's experience of, among other things, gas-engine breakdowns and their causes.

Instances of the breaking of bolts are given. We will here only refer to one. The engine was a horizontal one, a year old, with cylinder 17 inches diameter by 25-inch stroke, running at 170 revolutions per minute, with lighting gas from a town main. The bolts in the little end of the connecting-rod broke, liberating the rod, which drove the piston into the clearance space, where it caught and broke the air and exhaust valves. The piston and liner were both cracked, and the connecting-rod bent. The bolts were 1 inch diameter, with a cross-sectioual area of 0·554 sq. in. at the bottom of the thread. The load upon the bolts due to the inertia of the piston, which weighed 560 lbs., was about 6800 lbs., and the stress upon the bolts about 6250 lbs. per square inch. The stress due to the friction of the piston may have been very small or very large, depending upon lubrication and temperature. As a similar breakage occurred three months previously, just before the engine was insured, the diameter of the new bolts was increased to $1\frac{1}{8}$ inches over the crests of the screw-threads and near the head, and at the middle of the shank for centreing the brasses. Between the enlarged parts the diameter was reduced to $\frac{15}{16}$ inch. Three months later the new bolts broke. The lower one seems to have broken first through the bottom of the screw-thread next the shank. The other broke through the shank after being reduced $\frac{1}{16}$ inch in diameter by stretching. The piston was again driven back into the clearance and broken; the liner was cracked; the air and exhaust valve spindles bent; and the cylinder cracked circumferentially. The connecting-rod also was bent. After these three failures, the bolts were dispensed with, and a solid-ended rod supplied.

Many more examples might be given, but unfortunately they would not make clear why the bolts give way, or how the breakages are to be prevented. At first sight it might be thought that in a four-stroke-cycle engine the connecting-rod bolts would be practically free from stress, since the connecting-rods are in compression during both the explosion and compression strokes, and probably the bolts in the rods of many of the earlier gas-engines were designed with this idea. That such bolts should break, is not astonishing. The pistons and connecting-rods of medium-sized gas-engines weigh about $3\frac{1}{2}$ lbs. per square inch of piston area, and the force required to put them into motion at the commencement of the outward stroke, and bring them to rest at the end of the inward stroke, usually varies between 30 and 50 lbs. per square inch of piston area. At the beginning of the suction-stroke, and at the end of the exhaust-stroke, this force is applied by the crank-pin, and is transmitted through the connecting-rod, putting a tensile stress on the bolts. The friction of the piston during the suction-stroke adds to this inertia stress, and may increase it enormously if the piston be insufficiently lubricated, or become unduly expanded by heat. The inertia stresses on the bolts in the connecting-rods of modern gas-engines usually lie between 3000 and 5000 lbs. per square inch. Having regard to the possibilities of piston friction, it seems that these stresses do not allow sufficient margin. But in many gas-engines the bolts in the big ends of the connecting-rods are exposed to bending as well as to tensile stresses.

Respecting the breakage of bolts through the screw-threads. The difficulty of cutting screws without any error in pitch is well known—in fact, very few nuts have the same pitch as the bolts they are supposed to fit. Thus mutual pressure between the threads of a nut and bolt is not generally the same on all threads. If the pitch of the screw in the nut is longer than the pitch of the bolt, the stress is greatest on the thread furthest from the shank; but if the pitch of the nut be shorter than the pitch of the bolt, the stress is concentrated upon the threads nearest the shank. Obviously, a short-pitched nut on a bolt exposed to tension and shock like a connecting-rod bolt, is a dangerous thing. It tends to cause a fracture separating the nut and bolt completely.

A few other occurrences selected for special mention may be alluded to. Here we find the case of a horizontal gas-engine, six years old, with cylinder 10 inches diameter by 18-inch stroke, running with lighting gas from a town main at 170 revolutions per minute. The air for the cylinder charge was drawn through the framing of the engine, and not through an air-box and pipe, as is usual. When starting one morning, an explosion occurred inside the frame, shattering and blowing away a hand-hole door, and fracturing the frame in several places. The explosion was caused by the ignition of an explosive mixture formed inside the frame by passage of gas past the gas-cock, the gas-inlet valve, and the air-inlet valve into the frame. It is always difficult to ascertain exactly the conditions preceding the occurrence of these explosions. It is evident, however, that there must be pressure in the gas-supply pipe, and that the cock on this pipe must be left open when the engine is stopped, or must be leaking. Secondly, the gas and air inlet valves must either be very leaky, or the engine must be stopped on the suction stroke with one or both of these valves open. Under such conditions, gas can find its way through

the cylinder and air-valve into the air-inlet pipe or into the frame, when, as in the case cited, the air is drawn through the flame. The explosion of the mixture formed may be caused during the working stroke by leakage of flame past the leaky air-inlet valve, or on the opening of the air-valve at the beginning of the suction stroke by flame lingering in the cylinder. It may be said that such combinations of circumstances can occur but rarely. That may be true. But the occurrence of explosions proves that they do occur sometimes; and when they do occur, it is better that the air-pipe should suffer than the frame. Mr. Longridge considers himself justified in advising an alteration of the arrangement when air is drawn through a frame.

An example of another form of defect is in the case of a horizontal gas-engine, five years old, with cylinder 7¾ inches diameter by 13-inch stroke and a speed of 200 revolutions per minute. On finding the engine standing at one of his visits, the Inspector noticed that oil was working out between the fly-wheel boss and the shaft, and that the key did not appear to fit very well. He therefore advised the owner to have the key refitted; and at the same time to carefully clean and examine the boss, particularly the corners of the keyway, for cracks. As he feared, a fine crack was discovered from one corner of the keyway nearly through the boss. It was also found that the keyway in the shaft, which had apparently been cut by a revolving cutter, was not of the full depth throughout the length covered by the boss, and that the key, after being driven for a certain distance, was arrested by an inclined plane, between which and the bed of the keyway in the wheel boss, its point was wedged. So held it could not be kept tight; and constant attempts to make it tight by driving it had no doubt split the boss. The fly-wheels of gas-engines are so frequently found loose by the Company's Inspectors that Mr. Longridge doubts whether the keys used are either deep enough or sufficiently tightly fitted against the driving surfaces of the keyways in contradistinction to the beds. It is also doubtful whether many of the fly-wheels fit their shafts well enough to be held securely by one sunk key. These wheels in very many cases are loose enough to slip easily on to their shafts when the engines are erected at the purchasers' works. If shafts were always bossed-up to receive the wheels, and if two keys of a thickness more nearly equal to their widths than to half their widths were used, there would probably be less trouble with the keys.

The report includes a little admonition on the subject of bearing oil-cups. These are generally small, sometimes difficult to get at when the engine is running, and often neglected. Ring-oilers, in Mr. Longridge's opinion, would be much better, and ought to be adopted. Then many deposit accumulations are noticed; a case in illustration being a horizontal gas-engine, ten years old, with cylinder 16 inches diameter by 20-inch stroke, running at 160 revolutions per minute with lighting gas from a town main. In November, 1905, the cylinder end fractured, and was replaced. In November, 1906, the new end cracked. The cause was overheating, due to the accumulation of deposit in the water-jacket. The owners had been repeatedly advised to keep the water spaces clear, and professed that they were careful to do so—in fact, the Company's Inspector was informed that the jackets had been cleaned five weeks before the crack was noticed. Yet, when the end was taken off and broken, the whole of the heated surface was found coated, and the water spaces round the exhaust-valve chamber were completely filled with lime. Pieces of deposit ⅜-inch thick were removed from them. The case clearly proves the necessity for providing mud-holes in the jackets of the cylinders of gas and oil engines. The Company have urged this necessity for many years, but have been met by the argument that as the water never did attain, or ought never to attain, a temperature high enough to cause deposition of lime, mud-holes were not required. There is no doubt, however, that hard waters do deposit lime and dirty waters mud, and that provision should be made for removing both. Happily, the necessity is now being recognized, at least in the case of large gas-engines. Small ones, however, are still turned out in great numbers without any convenient means being provided for cleaning out the jackets of the cylinders.

It is not always, however, through overheating from accumulation of deposit that the ends of the cylinders of gas and oil engines crack. They are often found quite clean when broken up; and the breakages can only be attributed to stresses set up by some unequal expansion of the castings under ordinary working conditions. Here is a case in point. A horizontal gas-engine, two years old, with cylinder 17 inches diameter by 24-inch stroke, running at 200 revolutions per minute with town gas. The engine drove a dynamo. In November, 1905, the original cylinder end was replaced by a new one, with less clearance, in order to increase the compression to about 135 lbs. per square inch. In March, 1906, the new end cracked through the metal separating the water-jacket from the clearance space, and it had to be replaced. A year later, the third end failed in a similar way. Other cylinder ends exposed to similar temperatures and pressures have lasted much longer. As the castings are presumably made from carefully selected iron chosen by experience by each maker, Mr. Longridge is inclined to think that there must be some want of definite knowledge respecting the temperatures at which the metal should be run, and the conditions under which it should be cooled. Simplification of the castings, and abolition of flat rectangular surfaces and angles of 90°, is very desirable; and this, it is a source of satisfaction to note, is now being carefully attended to.

USE OF THE DE BROUWER RETORT CHARGING AND DISCHARGING MACHINE.

A recent issue of the "Journal für Gasbeleuchtung" contains the text of a paper read by Dr. J. Becker, of Frankfurt-on-Main, before the last meeting of the German Gas Association, in which the author gave an account of the experience he and other gas engineers had gained in the use of the De Brouwer charging and discharging machines.

According to the author, the introduction of machinery into a retort-house invariably reduces the amount of labour requisite, although the precise number of men whose services can be dispensed with, must depend upon local conditions. For example, the gas-works at Kaiserslautern formerly required nine men to manipulate every six retorts, but are now only employing five men to manage the machines that charge and discharge ten retorts. The works at Lichtenberg, near Berlin, employed eighteen men in twelve-hour shifts to make 350,000 cubic feet of gas, but now require only nine men in an eight-hour shift for the same purpose. Similarly, when 500,000 cubic feet of gas were made, the stokers numbered twenty-two; but now twelve men suffice for an identical output. Moreover, the work involved in attending to the De Brouwer machines is much easier and more healthy than that required where everything has to be done by hand.

In the second place, the use of machinery renders the charging and discharging operations more rapid than was possible heretofore. An 11 ft. 6 in. retort may be charged by two experienced stokers with 400 lbs. of coal in 80 seconds; whereas one man can charge it mechanically in from 8 to 10 seconds. Since the retort thus remains open for about two minutes less during the combined charging and discharging operations, a notable economy of gas is attained. The large quantity of smoke and dust produced may seem to signify a considerable loss of coal and gas; but this is not necessarily the case, and if the coal is not broken excessively small, serious waste does not occur. Unfortunately, gas coals are now being supplied, especially those, said the author, which come from England, containing a very large proportion of fine dust.

In the third place, the coal is charged into the retort with the aid of a machine far more uniformly than is possible when the operation is performed manually; and it must come as a surprise to any gas engineer who has had no previous experience on the subject to see how regularly a 15-feet retort is filled with coal by the De Brouwer charger. The coal, indeed, looks as if it had been smoothed with a rake. It is hardly necessary to say that such regular distribution of the coal makes for gas of high quality and yield. In conjunction with the greater rapidity of charging and discharging, the better distribution of the coal leads to so much higher a yield of gas that in one particular place where the coal employed was giving 10,050 cubic feet per long ton when charged by hand, the make rose to 10,450 feet when machines were laid down. On one occasion, Dr. Becker charged each of twenty-seven retorts by hand with 400 lbs. of coal, heated them to about 2124° Fahr. for 5½ hours, and measured the quantity of gas. On repeating the experiment under exactly identical conditions with the aid of the charging machine, and using the new Le Chatelier pyrometer mounted in quartz glass to observe the heat, he found that the make was much higher.

As the coal that is to be charged by machine has to be broken to a smaller size than that put into the retort by hand, the use of such high retort temperatures as 1300° C. (2370° Fahr.) encourages the production of retort carbon, thick tar, naphthalene, and ascension pipe stoppages. It is, therefore, desirable to work at a rather lower temperature, especially when the coal is small, and more particularly still when using English gas coal of small size. For the purpose in view, it is advantageous to mix English coal with German. Engineers sometimes say that high retort temperatures and a long carbonization period are desirable when the discharging machine is employed. This, however, is incorrect, provided the machines are worked properly. It occasionally happens that the coal is not so well carbonized at cooler parts of the retort (where, for example, it is supported on fire-bricks), as elsewhere, or that at the front lid it sticks together in large lumps. In such cases the coke can quite well be discharged by causing the machine to deliver a second or, if necessary, a third blow.

Eastern Counties Gas Managers' Association.—As already briefly announced in the "Journal," the thirty-eighth general meeting of the Association will be held at Gravesend on Thursday next, the 26th inst. The party will assemble at the Clarendon Hotel, where, by the kindness of the Chairman and Directors of the Gravesend and Milton Gas Company, they will be entertained to luncheon. Brakes will then convey the visitors to the gas-works, which will be open for inspection. The business meeting will be held in the Masonic Hall; and afterwards dinner will be served at the Clarendon Hotel. The following day, a drive through Dickens's country to Cobham Hall (which will be open for inspection by permission of the Earl of Darnley), and from there to Gad's Hill, has been arranged for. Beyond the formal business, the only item on the *agenda* is the delivery by the new President (Mr. Joseph Davis) of his Inaugural Address.

GAS-WORKS EXTENSIONS AT MONIFIETH.

In view of the rapidly-increasing consumption of gas at Monifieth, the Town Council recently asked Mr. A. Morton Fyffe, Assistant Engineer at the Dundee Gas-Works and Consulting Engineer to the Monifieth Council, to furnish them with a report on the works, and the necessity of alterations and extensions thereto. The Council met last week to consider the report, and decided to adopt Mr. Fyffe's scheme, and to proceed now with the first part recommended—namely, the erection of a gasholder of 50,000 cubic feet capacity, prepared for telescoping, and the provision of a 10-inch main governor and a cart steelyard. The cost of this work will be about £2000. In proposing that these extensions should be carried out, Bailie Fenton, the Convener of the Gas Committee, pointed out that during the few years the works had been under the control of the Council the consumption had increased from 5 to 7½ million cubic feet.

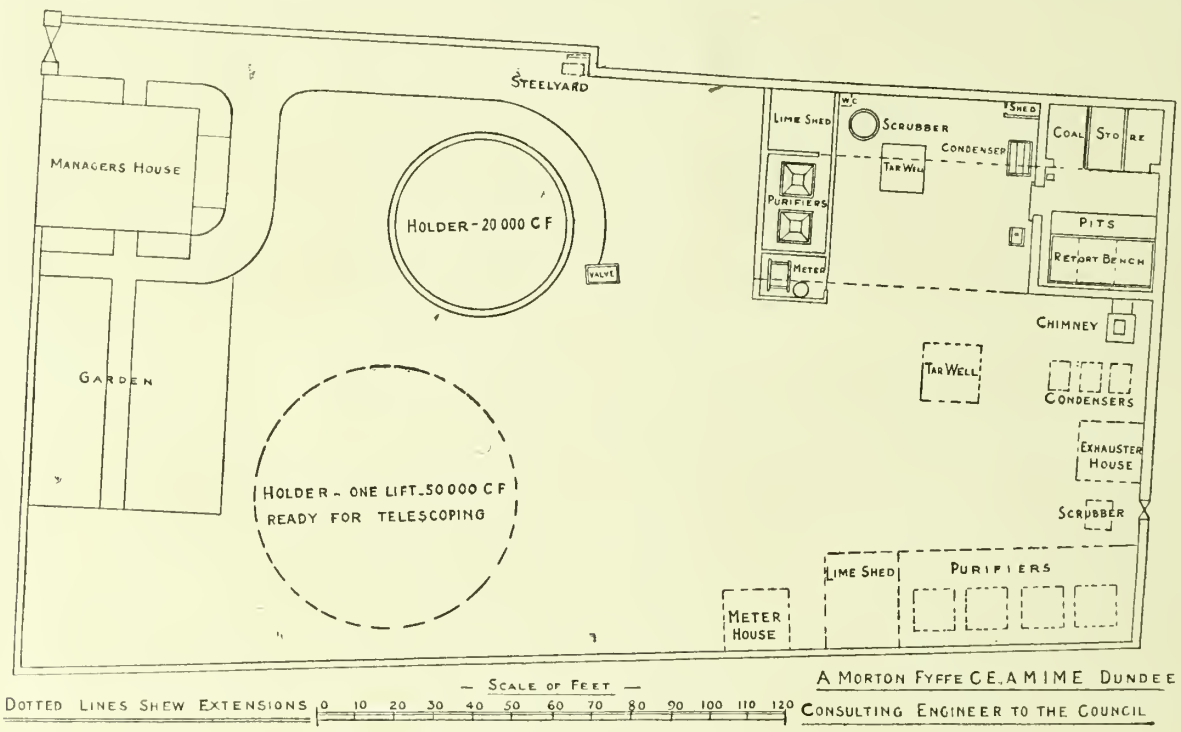
In the course of his report, Mr. Fyffe said he had considered the questions of extensions, alterations, and additions to the existing plant; and after taking into account the increasing consumption of gas and the obvious growth of the town, he had come to the conclusion that in the next few years it would be absolutely necessary to extend and add to the whole of the existing plant, and also to add new appliances. It was impossible to undertake all this at once; but in order that the various works should form a complete scheme, he had drawn up the following proposals, which are shown on the accompanying plan. Before, however, doing this, it was necessary to fix the capacity of the works when completed; and as the present demand during the heavy load time in winter was between 30,000 and 40,000 cubic feet a day, he had based his scheme on an output of 100,000 cubic feet a day. Thus the plan submitted obviated the necessity of extending the ground area of the works until a maximum daily consumption of 100,000 cubic feet was attained. Mr. Fyffe then gives the following outline of his proposals.

Retort-House and Coal-Stores.—The scheme provides for the retort-house and coal-stores being extended westwards to the west wall of the existing purifier shed. The purposes of this arrangement are: (*a*) Utilizing the existing buildings. (*b*) Utilizing the existing chimney. (*c*) Obviating the need of extending the ground area. (*d*) Having the coal-stores next the railway, in the hope of having a siding constructed in the future. As will be seen from the plan, the condensers, tar well, scrubber, purifiers, meter, &c., are at present on this site; but they would be re-erected on the new positions shown. This arrangement is the cheapest one for the extension of this part of the works; the west wall of the present purifier-shed being used, while the stones obtained from the west gable of the retort-house could be used in the new portion of the south wall.

Steelyard.—A cart steelyard is required to check the weights of coal, &c., entering and leaving the works, and should be placed as shown west of the extended coal-store.

Condensers.—The existing condensers would be removed to the new position indicated, and added to as required.

Exhauster, Engine, and Boiler.—The scheme provides for a gas-exhauster, driven by a steam-engine, and housed as shown in a brick building on the east wall. The relative steam-boiler would be placed in the extended retort-house, so that it could be attended to by the man in charge of the retorts.



Extension Plan of the Monifieth Town Council Gas-Works.

Scrubber and Washer.—The existing scrubber is now too small for present requirements, and would be replaced by a modern type of scrubber-washer. The present scrubber would then be sold to some smaller works.

Purifiers.—There are at present two purifiers, each 8 feet square, which are too small for efficient and economical working with the existing load. These would be sold, and a set of four, each 10 feet square, obtained (second-hand if possible), and placed at the south wall as shown. This arrangement would give 400 superficial feet of purification area, as compared with 132 superficial feet now. Little expense would be incurred in housing the new purifiers; a light iron roof carried on girder uprights being all that would be required.

Meter.—The existing meter, which was installed last season, is of ample capacity for the load contemplated; but at the completion of the scheme it would be housed in a brick erection, situated at the south wall as indicated. This house would also accommodate the governor-tank and regulating bell and gauges, described later under the heading of "Governor."

Gasholder—Gas-Storage Accommodation.—The existing gasholder has a capacity of 20,000 cubic feet, which is about 12 hours' supply during load time. This storage is, of course, totally inadequate for present demands; and so long as this remains the only storage accommodation, very serious responsibility and risk are being undertaken by those in any way responsible for the gas supply of Monifieth. While some parts of the works extension might be postponed, the question of storage offers no alternative. The scheme therefore provides for additional gas storage, by the erection of a holder with steel tank; the gasholder being in one lift, about 60 feet diameter by about 18 feet deep, and giving a capacity of 50,000 cubic feet, and so constructed that another lift could be added when required. It would not be advisable to increase the capacity of the present holder by adding another lift. Moreover, the works would still be in the undesirable position of having only one holder, which even then would not be of sufficient capacity. I would recommend that this proposed gasholder be on the girder-column system, externally guided, and independent of any cables or chains, in consequence of the position of the works, where high winds are experienced.

Governor.—The present governor on the main-outlet to the town is quite useless for the increasing consumption; and it will be necessary to introduce an efficient and modern type, to control the pressure on the outlet. This governor would be fitted at the outlet of the gasholders, while the tank, bell, and gauges would be housed in the new meter-house. Meantime, however, this would be placed in the present meter-house; and when the new meter-house is erected, it can be easily transferred by simply lengthening the lead air-pipe.

As already stated, it is impossible to undertake all this work at one time; and it could be arranged to divide it over (say) three or four years. But there are some parts of it that must be proceeded with at once—namely, the gasholder, governor, and steelyard. For the purpose of having a stock of coals on hand, and ensuring that the coals be dry when put into the retorts, it is proposed that, as a temporary arrangement, a light iron roof be erected between the present retort-house and the tar-well, to form a coal-store of a capacity of about 70 tons. The works which are recommended to be proceeded with now would be specified in the autumn, so that they could be manufactured in the contractor's workshops in the winter, during the slack season, which would give the advantage of low rates; and they would be erected at the gas-works in the early spring of 1908.

REGISTER OF PATENTS.

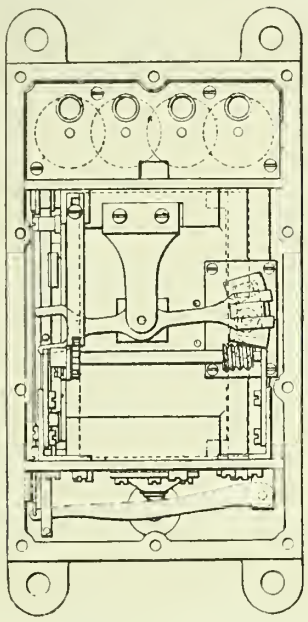
Liquid Meters.

CAHILL, D., of Paris.

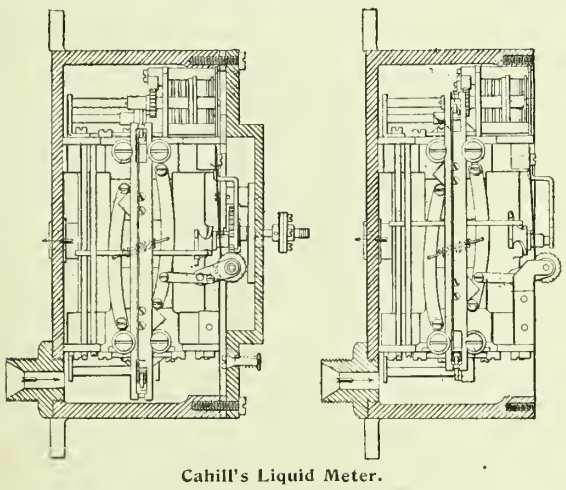
No. 18,513; Aug. 17, 1906.

This invention relates to liquid meters of the class described in patent No. 18,511 of 1906; the object being "to simplify the construction of such meters, to render certain of the parts more positive in operation, and to reduce the friction of the working parts."

The invention consists in actuating the counting and indicating mechanism and the slide-valve in such a manner that the work involved in actuating the former and in giving the latter its initial movement is done positively from the movement of the piston controlled levers, whereby the spring which acts on the levers engaging the cams of the shuttle-bar is relieved of all work other than that of rapidly completing the throw of the slide-valve.



The illustrations show a plan of the meter with the cover removed; and (to a smaller scale) side sectional elevations of the meter, showing he shuttle-bar in its two extreme positions.



Cahill's Liquid Meter.

The invention further consists in arranging the shuttle-bar so that, although its initial movement is positively effected by the piston controlled levers, it may, under the action of a caliper or like lever spring, have considerable free movement along its normal path in relation to the piston controlled levers, and in connecting these last two levers together independently of the shuttle-bar. By these means, the movements of the piston controlled levers are reduced to a minimum in relation to the movement of the shuttle; and by connecting the levers together there is overcome, during the positive movements of one piston-rod, the frictional resistances of the other piston-rod and the counter pressure of the liquid at the back of the diaphragm of the other rod in returning to its initial position.

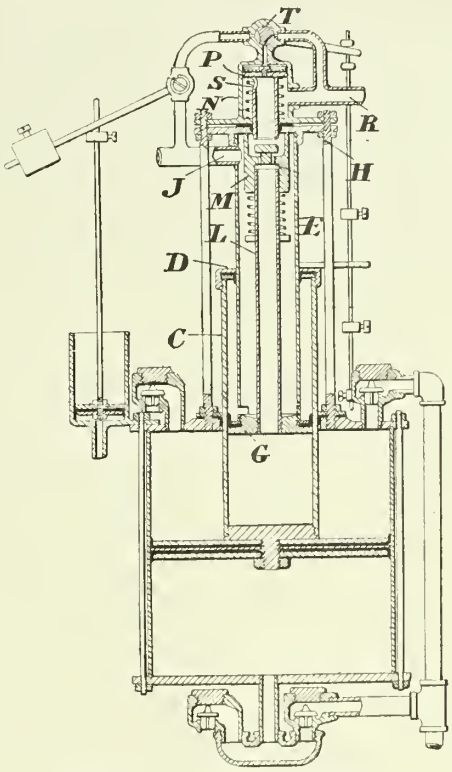
Among other objects aimed at are: (1) Pivoting the levers which engage cam-surfaces on the shuttle-bar at opposite ends of the cylinder to each other—the cams being correspondingly changed in position, so that the force exerted by the spring controlled caliper levers upon the shuttle shall be the same in either direction. (2) Forming the discharge port of the slide valve very small in relation to the two side or inlet ports, and arranging the slide valve so that, in its mid-position, both side ports are slightly uncovered, whereby the tendency of the slide valve to bind upon its face (as where a rapid discharge of liquid takes place) is avoided, and friction is consequently much reduced. (3) Operating the indicating mechanism through a worm, the shaft of which is rotated from a ratchet wheel and pawl controlled from a caliper lever or other positively actuated part; the worm being arranged to gear with a worm wheel (mounted after the manner of a free-wheel) upon a spindle provided with a valve face and passing through a separating partition—the spindle having upon its other end a pinion gearing with the indicating mechanism. (4) Means for locking the valve against movement under vibration or the like.

Gas-Pressure Raisers.

GOODRIDGE, R. H., of Upper Tooting, S.W.

No. 19,484; Aug. 31, 1906.

This invention relates to gas or air compressors actuated by water pressure, and is particularly suitable for compressing air to supply heating gas-burners—"being even in action and capable of being operated by a low-pressure water supply or for supplying gas at a pressure greater than the ordinary gas supply."



Goodridge's Gas-Pressure Raiser.

With the apparatus shown, water is supplied from the main, through the pipe J, to the interior of the tube E passing into the upper annular chamber of the piston-rod C, acting between the upper head D of the rod and the piston G, and so carrying the main piston-rod and its piston upwards and compressing the air above the latter. The main piston-rod having reached the upper end of its travel, operates (by tappet action) the cock T, which brings about communication between the main water supply and the upper surface of the piston P, and tends to force it down together with its tubular piston-rod, which latter contacts with the valve face on the sliding valve M and closes the exhaust way through the ports R S, and by a continued movement forces the valve M off its seat. This being formed with perforations extending from its upper surface to the part of its lower surface located above the end of the tube L, the water from the supply passes through the valve M and down the tube to act within the lower chamber of the main piston-rod C and force the main piston downwards, so as to compress the air beneath it. Upon the main piston reaching its lower position, the tappet action takes place and changes the position of the valve T to exhaust, and the piston P is immediately lifted by its spring, raising the valve seating of its tubular rod and permitting the sliding valve M to contact with its seating on the closing plate H; thus closing the water supply to the tube L, and therefore to the lower chamber of the main piston-rod C. Then as the main piston-rod rises, the water in its lower chamber exhausts up the central tube L and through the perforations in the sliding valve, passing through the open end of the small piston-rod and out through the ports S R.

When the air pressure generated either in the supply pipes or a reservoir reaches some predetermined limit, it is desirable to throw the machine out of action until the pressure has been reduced, and to this end a regulating piston is provided in a stationary cylinder; the lowest end of the latter communicating with an air reservoir or supply pipes. The regulating piston actuates, by means of a rod, a cock in the supply pipe from the main which supplies the valve at the upper end of the small cylinder N, so that the piston-rod of the regulating piston cuts off the supply and the apparatus becomes stationary, because the water supply is stopped to the surface of the piston in the cylinder N.

Gas-Engines.

MARKS, E. C. R.; a communication from the SOUTHWARK FOUNDRY AND MACHINE COMPANY, of Philadelphia, U.S.A.

No. 19,539; Sept. 1, 1906.

This invention relates particularly to the valve gears of gas-engines—having for its object to simplify and make more accessible the valves and valve actuative mechanism of such engines. Important features of the invention are the actuation of both the admission and exhaust valves of double acting four-cycle gas-engine cylinders by two cranks set at 90° apart and revolving at one-half the speed of the main shaft; each crank being connected to an admission valve at one end of each cylinder and an exhaust valve at the opposite end. For the best

effects, the cranks directly act upon and reciprocate a series of cams by which motion is given to the valves; and, by preference, the cranks give motion to two parallel reciprocating rods to which sliding cams are attached. The cams actuate rocking levers, which in turn actuate the valves; and it is an important feature of the invention that the admission valve casing should be situated above the cylinders, the exhaust valve casings at the side and at the bottom of the cylinders, and the cams above the exhaust valve casings.

Inverted Gas Lamps and Burners.

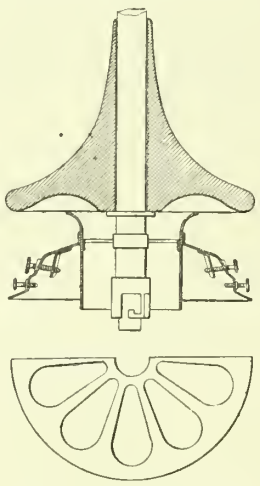
HELPS, GEORGE, of Nuneaton.

No. 23,804; Oct. 26, 1906.

This invention refers to heat diffusers in combination with draught inducers and globe and shade holders for incandescent inverted gas-burners.

One of the chief features in the invention is the splitting-up of the products of combustion and diffusing them over a large area. In ordinary practice, says the patentee, the products of combustion are allowed a free exit in any direction, or if in one direction the area of the outlet is so large that unconsumed gas escapes into the room and the burner is easily affected by draughts. This invention provides for the control of the waste gases and the exclusion of flies, dust, and the like from the globe.

The products of combustion are conveyed into a space or chamber (or several spaces or chambers) having connections with the globe, chimney, or draught inducer on the one side and connections with the atmosphere on the other; the outlet connections being so arranged that the burner may be lighted at them.



Helps' Inverted Gas-Lamp.

One form of diffuser (shown) is that in which a china cone has many indentations or hollows in its base—thereby "presenting a large area to the products of combustion which escape from the burner and which retains sufficient heat from the products of combustion that it is able to consume any carbon that may have escaped complete combustion at the burner." Or the diffuser may consist of a hollow perforated shell of metal or other suitable substance provided with an inner disc or partition.

In conjunction with the heat diffuser, a cylindrical draught inducer or chimney, to which the holder for the shade and globe can be attached, may be secured to the burner-tube by a bridge having its centre screwed so that it may run on a thread cut in the burner-tube. Thus the waste products are confined to the draught inducer until they reach the indentations in the heat diffuser, when they escape into the room through the whole or part of the circumference of the heat diffuser in very small streams.

Photometers.

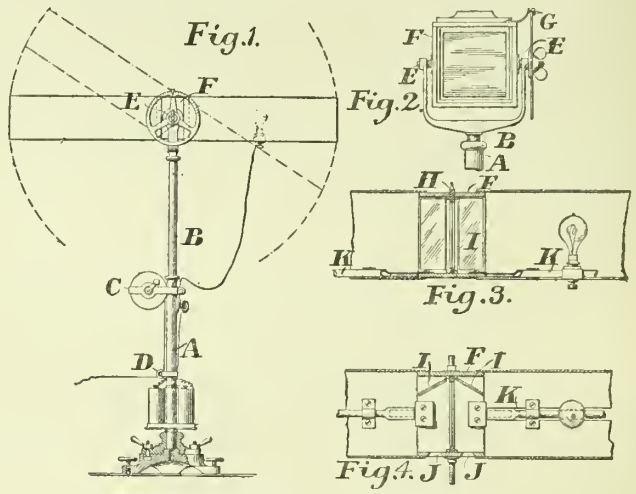
WELLINGTON, S. N., of Maida Vale, W.

No. 6316; March 15, 1907.

The object of this invention is to provide means by which the intensity of light received upon a surface from one source can be compared with the intensity of light received upon the same surface from another source, and the efficiency of the sources of light, so tested, easily compared by an arbitrary standard. At the same time, the invention aims at constructing apparatus that, while it can be used "to obtain a quick and ready approximation of the differences in intensity of the light from various sources, yet is capable of being fitted with additional devices converting it thereby into a simple and portable photometer."

There is provided an open-ended tube, rectangular in cross section and not of great length compared with its diameter—that is, it may even be less in length than its diameter—and fitted to receive a frame to carry a sheet of printed matter in a plane extending transversely of its axis. The tube is carried upon horizontal trunnions extending at right angles to the axis, the frame being fitted with means whereby any angle which the axis of the tube is made to assume relatively to the horizontal plane can be ascertained, and means being provided by which the tube can be clamped at the angle to which it has been set. The stand is further provided with a measuring tape by which the distance of the axis of the apparatus in a horizontal direction from the source of light can be measured; and then if the source of light which is being tested requires the tilting of the tube, the distance of the printed matter in the tube from the centre of the light being tested can be readily ascertained by calculation—the base of a triangle being given by the linear measurement so taken by the tape, and the angle of the hypothenuse corresponding to the angle at which the tube is placed relatively to the horizontal plane.

If the letter-press on the sheet which is to form the standard is such that with normal eye-sight it can be clearly read with the light from a source at a specified and known distance, then it is obvious, the patentee remarks, that a printed sheet having precisely the same characters can be taken to another source of light, and placed at such distance from it that it can be read, and then a comparison between the intensity of the first source of light and the second can be made in terms of the distance of the printed matter from the sources of light, and when the instrument is used in such manner. This he calls a "liro-meter," and the terms of the distance he calls "lires."



Wellington's Arrangement of Photometers.

Fig. 1 is an elevation of the apparatus with the extension tubes in position as when the instrument is to be used as an ordinary photometer. Fig. 2 is an end elevation of the rectangular section short tube and its carrying frame. Fig. 3 is a longitudinal section of the tube and extension tubes. Fig. 4 is a sectional plan of fig. 3.

The apparatus consists of a metal base formed with feet and fixing or adjustment screws. The base supports an upper turn-table revoluble about the axis of the base and having clamping screws by which it can be fixed in the position in which it has been placed. The turn-table supports a vertical upstanding tube A carrying a telescopic rod B fixed at the desired elevation by a clamping screw. Upon the tube A is mounted a bracket C carrying a drum containing a thin steel measuring tape passing under a pulley D on the tube A. The drum may be fitted with a ratchet and pawl or some other brake device, so that the tape may be stretched with some degree of tension to avoid sagging.

The upper end of the rod B is formed with a fork, the upper ends of which form bearings for trunnions E, one upon each side of an open-ended box or tube F, one of the trunnions, extending through the bearing of its fork, being fitted with a screw by which the tube can be clamped in any angular position relatively to the horizontal plane. The tube carries a pointer G indicating upon a graduated circle to show the angle at which the tube is placed. A slot is formed in one wall of the tube extending the full diameter of it, to receive a frame adapted to carry one of the test sheets of printed matter, or to carry a sheet having a grease spot, according to the kind of test to be made.

When a "lirometer" test is to be made, the sheet of printed matter carried in H is inserted as shown at figs. 2 and 3. The apparatus is placed so that the axis of the trunnions of the tube F is horizontal, and then the tube is turned about its trunnions until its axis is in a line with the light to be tested. The apparatus is then moved nearer to or further from the source of light, "until the printed matter can easily be read with normal eye-sight," by the operator looking in at the open end of the tube.

This having been done, the distance from the source of light is measured in a horizontal direction, and the angle of the axis of the tube is taken by a reading from the graduated circle. The distance of the test sheet from the light having thus been ascertained, the efficiency of the light can be compared with others "as will be well understood."

In order to permit the same apparatus to be used as a photometer, the tube is fitted interiorally upon one side with mirrors I placed at such an angle as to reflect both sides of the sheet carried by the frame H, which then has the usual grease spot, while sighting apertures J are formed in the side of F, which are generally provided with shutters for closing them when not required.

On opposite edges of the base of F are two extending studs or brackets to receive the flattened ends of two metal tubes K provided to support extension tubes made of cardboard and blackened on the interior. These extension tubes are made slightly larger in section than F, so that their ends take over and embrace its ends. In the construction shown, one of the tubes is adapted to carry an adjustable bracket carrying an electric lamp supplied from a battery near the base of the tube A. So fitted, the apparatus can be used in the ordinary manner of a Bunsen photometer; the adjustable lamp acting as the standard light.

Supplying Air to Inverted Incandescent Gas-Lamps.

PÖSCHL, A., of Berlin.

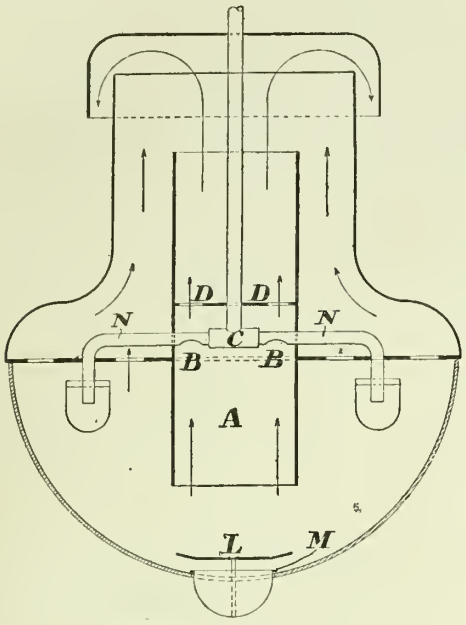
No. 14,254; June 20, 1907.

These means for supplying air to inverted incandescent gas-lamps consist of vertical plates in the form of a cross, star, or the like, arranged in a hole at the bottom of the globe of the burner, and serving as a distributor of the currents of air.

The lamp consists of a distributing piece C, suction chambers B, which open downwards, mixing-tubes N led directly outwards and then bent down with their mantles, a suction shaft A with suction holes D, a casing with chimney, cap, and gas supply pipe.

It is essential that the opening M at the bottom of the glass globe is protected in such a manner that the supply of fresh air is not cut off

from the lamp when the wind blows. For this reason vertical metal plates in the form of a cross or star are inserted in the hole, "which do away with, or neutralize, the puff of wind coming from one side and



Poschl's Inverted Lamp.

admit air at the other side on account of the vacuum which is formed." These metal plates may be provided with another distributing plate L, mounted horizontally over them.

APPLICATIONS FOR LETTERS PATENT.

5972.—Brown, T. W., "High-Pressure gas lighting."
20,109.—Robson, G., "Distance turning on and off of gas-burners." Sept. 9.
20,118.—Marsh, J., "Acetylene generators." Sept. 9.
20,139.—Feld, W., "Treatment of coal gas and analogous gases for the obtainment of extraneous matters, such as tar constituents and ammonia." Sept. 9.
20,153.—Turner, A., "Inverted burners." Sept. 10.
20,176.—Gertz, M., and Scheef, H., "Air-gas apparatus." Sept. 10.
20,199.—Bouvier, A., and Collon, E., "Mixing, measuring, and carburetting gaseous bodies." Sept. 10.
20,208.—Bailey, G. W., "Water-gas plant." Sept. 10.
20,233.—Bennett, F. I., and Tapley, W., "Suction gas producers." Sept. 11.
20,263.—Hotton, W., "Anti-vibrating fitting." Sept. 11.
20,301.—Detsinyi, G., "Gas-burners." Sept. 11.
20,316.—Smith, B., "Fuel for gas-stoves." Sept. 12.
20,322.—Nacht, S., "Geysers." Sept. 12.
20,330.—Cross, W., and Son, Ltd., and Kirby, J., "Inverted burners." Sept. 12.
20,352.—Tonkin, W. W., and Puplett, S., "Gas-producer." Sept. 12.
20,386.—Cowper-Coles, S. O., "Extraction of sulphur from sulphur compounds." Sept. 12.
20,500.—Feld, W., "Extraction of ammonia from coal gas and analogous gases." Sept. 14.

Street Lighting in Bermondsey.

The County of London Electric Supply Company, Limited, recently wrote to the Bermondsey Borough Council suggesting that the main streets of St. Olave district be lighted with 48 arc lamps. The Company pointed out that they had distributing mains in these streets, so that a detailed supply could be given at the terminals of each lamp, and the Council would therefore be relieved from all losses of distribution. The proposal would replace 133 of the existing lamps. The price suggested to be charged for current would be 1¼d. per unit for an all-night supply. The Electricity and Street Lighting Committe reported last Monday week that they had, after careful consideration of the matter, informed the Company that they were not prepared to accede to their request. The Committee further reported having had under consideration the necessity of improving the lighting of Tooley Street (one of the streets referred to by the Company), which in the early hours of the morning and late in the evening is one of the most important business thoroughfares in the borough. The lamps at present in use had been in existence for a great number of years—being the earliest incandescent gas lighting in the borough. The present condition of the burners rendered it necessary that they should be renewed almost immediately; and the Borough Surveyor suggested that each lamp be put in thorough repair, square heads substituted for the circular heads, and two No. 4 incandescent Kern burners fitted in each lamp—giving a nominal illumination of 200-candle power per lamp. The cost of this will be £70 8s. 4d., £30 of which is already provided in the estimates for the repair and renewal of the existing lamps. There are 50 lamps on the route; and the cost of the upkeep will be £5 4s. per lamp per annum. The Committee had already instructed the Surveyor to put the work in hand without delay, in anticipation of the winter season.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Gas-Heating Business Field.

Sir,—My attention has been called to your article and the correspondence on this subject. I am most impressed with the remarks of Mr. Harman, of Huddersfield. There can be no doubt the want of success in the introduction of gas-fires in the past should lead to an inquiry as to why this class of heating has not been more generally adopted.

Being by profession an Architect, the question of domestic heating has very frequently been one of the subjects calling for my attention. I have found that the general public as a rule have formed the opinion—right or wrong—that gas heating is too expensive a luxury to be considered. Many of those whom I have come across say they have had experience of gas-fires; but I find in most cases that the experience was gained some years ago.

Personally, I know that rapid steps have been made in the improvement of systems of lighting by gas; but I have yet to learn that progress is being made in the systems of domestic heating. If the exhibition to be held in Manchester is such as to prove that a room can be heated comfortably at a reasonable expenditure of gas, and that the expenditure can be checked by the consumer, then I believe that the makers of such appliances will have not only the support of architects, but also of the public whose wishes they have to meet.

In Mr. Harman's letter he refers to the "miserable little register stoves." He further points out that the projecting of a gas-fire into an already small bed-room is not a desirable addition. Would it not be well that manufacturers of gas-fires should examine into the whole subject, and that some leading spirit should prepare diagrams showing the present methods of heating by coal, pointing out how they could be improved, and, further, presenting a model of what they think should be the class of register grate made a standard for use and suitable for adaptation to gas-fires? If these details were worked out in a practical manner, I know from my own experience that they would be fully considered by the architectural profession, and a big step forward would have been made towards that time when gaseous fuel shall become the rule and not the exception, and when we shall be able to look back with a certain amount of satisfaction and point out that not only has domestic labour been minimized, but that the adoption of improved methods has done much to purify the air.

Nursery Road, Prestwich, Sept. 20, 1907. Harry H. Clegg.

Sir,—Anyone who has carefully followed the recent improvements in heating houses, either large or small, by means of gas-fires, in place of the old-fashioned, dirty, and laborious coal-grates, can but acknowledge that there is an immediate necessity for gas folks to bring out at once a register gas-fire. This would be most acceptable to householders as a vast saving machine—not only financially, but doing away with much fatiguing work, and at the same time rapidly heating rooms and thoroughly ventilating them.

In the past, and to a great extent to-day, the abominable canopy gas-fire holds the field; and the makers, gas authorities, plumbers, &c., are endeavouring to find out why these ancient relics do not become more popular, and why they are not at once introduced into houses by builders, in place of the ordinary coal-stove.

Facing me (in a friend's house) at this moment there is fixed a canopy fire in front of a coal-grate, which has been most carefully closed up by a sheet of iron. The flue-pipe of the fire is barely sufficient to carry away the products of combustion, and any overplus of fumes must come into the room. In addition, a certain amount of air is sucked in at the bottom of the fire, between the brick and the ornamental ironwork. This, passing upwards, gets robbed of its moisture; thereby creating a dry, unwholesome atmosphere in the room. To counteract this, it is customary to get a saucer, soup-plate, or even the dog's drinking dish, and place it in front of the gas-fire filled with water. The unhappy innocent does this, thinking to replace the moisture extracted from the air. Can anyone imagine anything more unscientific?

A distinct advance has been made with a class of fire known as registers, which practically obtain the conditions of a coal-fire. In my own house, I began with canopy gas-fires; but, owing to the smell and the evil effect on the atmosphere of the room, I was obliged to throw them out—the conditions being altogether too unhealthy. About the time when I became so disgusted with the canopy style, the register type of gas-fire came on the scene. I was willing to try anything rather than go back to the coal-grate; so the canopies were scrapped and registers were installed—care being taken that the dampers were left wide open. Since this removal, and the introduction of the register fire, the rooms have been better heated, perfectly ventilated, and consequently more habitable. My personal doctor was so charmed with the improvement that he has had all his coal-fire grates taken out and replaced by the register gas-fire; and he frequently thanks me for the vast improvement in the condition of his rooms.

An American engineer called upon me, and could not understand how a gas-fire could be in a room and yet the air remain perfectly sweet. I lighted a taper, and held it to the damper opening. It was instantly extinguished. My friend said that he guessed it was all correct, but thought the fumes of the gas-fire had helped somewhat to extinguish the flame. I therefore relighted the taper, and held it in the open space between the fire and the damper, where it remained alight. My American was convinced, and said: "You Britishers are not quite so 'darned' slow as people sometimes give you credit for."

Plumbers and fitters are sadly in want of educating as to the fixing and working of these gas-fires. My plumber knows something about drains; and he evidently thinks that drains ought to remove everything, even the products of combustion of a gas-fire, because he will insist upon completely shutting the dampers each time he overhauls the fires. For six years have I tried to convince him of the importance

of open dampers; but he is hopeless. If gas-fire manufacturers would only give one tithe of the attention they have spent upon that ancient relic, the antiquated canopy fire, to the production of an up-to-date register gas-grate—thus heating the room hy radiation instead of convection—and utilizing the hot waste gases to ventilate the room, doubtless the architects whom we have been endeavouring to propitiate with unscientific and unsightly fires would be only too glad to include a scheme of gas heating in contradiction to coal-fires.

We Englishmen are inclined to be too conservative in our methods, and dearly love the old idea of the open fire-places of our forefathers. One might as well go in for halfpenny rushlights. In these days of dear coal it is time the general householder looked round for some other and better method of heating. I feel convinced that gas will supply this want; and with a good register fire, well taken up by the architects, &c., the householder will quickly appreciate the benefits given to him by the introduction of the register gas-grate.

J. Stead Hedley.

Heaton, Sept. 21, 1907.

John Wright and Co. and Arden Hill and Co.

Sir,—I observe in last week's "Journal" reference is made to John Wright and Co. and Arden Hill and Co. as "these united concerns," an expression which I fear may be apt to create a wrong impression. Our Company includes four distinct businesses—Arden Hill and Co., the British Radiator Company, Limited, the Eagle Range Company, and John Wright and Co.—and, apart from financial arrangements, these concerns, in every other respect, carry on their businesses in an entirely distinct a way as in former years, having each their own works, management, staff, and travellers.

I am naturally wishful that the numerous friends who have for many years done business with both John Wright and Co. and Arden Hill and Co. should not be led into the error of supposing anything has taken place to diminish in any way the distinct identity (I might almost say personality) of the two firms.

H. James Yates.

Birmingham, Sept. 21, 1907.

LEGAL INTELLIGENCE.

VALUATION APPEALS IN SCOTLAND.

Following up our report of appeals against valuations in the South of Scotland last week, we are able to give the results of further appeals before the Valuation Committee of the Berwick County Council, sitting at Duns on the 12th inst.

The Eyemouth Gas Company appealed against a valuation of £184, as compared with £80 last year. Mr. Wood, Solicitor, objected to the Assessor taking the past year's working as a basis. Last year had been the best one the Company had had for a considerable time, and he asked for an average of (say) five years. He also thought that interest on borrowed money was a reasonable charge to come under working expenses. If this item were allowed, it would reduce the amount to £110. The Assessor said the gas-works of Berwickshire and the three southern counties had been undervalued very seriously for a number of years. He asked the Court to abide by the decided cases—taking the profits of the year, and allowing certain reductions. Interest had nothing to do with it. He referred to Dundee, Kirkcaldy, and other cases, and added that this was certainly not the year for the Company to come and ask for a reduction, when they had been underpaying to the county. Mr. Wood said the valuation of the Eyemouth Gas-Works was fixed at that Court years ago, and the Assessor had had ample opportunity of setting the matter right, the returns having been regularly made. The general practice was to take an average, and the Assessor himself had offered an average at Jedburgh only the other day. He (Mr. Wood) did not think it was right for him to do this in one case and refuse it in another. The Assessor said he was quite agreeable to take an average next year. Mr. Wood remarked that the Company were to be penalized because of the valuation of previous assessors. The Assessor pointed out that they had had the benefit.

The Duns Gas Company appealed against a valuation of £165, as against £110. Mr. J. Herriot, Solicitor, said that the former valuation was £70 for the works and £40 for the underground pipes. The Assessor had added £35 to the former, and £20 to the latter, making them £105 and £60 respectively. He was prepared to give way to the Assessor on all points except the salary of the Secretary, which he considered a necessary charge in the working expenses. The Assessor declined to accept any compromise, and said that all the cases were in his favour. Mr. Herriot said that the Assessor had greatly underestimated the capital necessary to carry on the works, and pointed out that £800 was certainly less than had been allowed in the Kirkcaldy case. The Assessor explained that in the Kirkcaldy case the Company had on their books £1000 for meters which were supplied free. In the case of Kirkcaldy, it was understood that in the event of a tenant taking over the concern, he would have to maintain these meters, and they were allowed for accordingly.

The Earlston Gas Company appealed against an assessment of £129, as compared with £70 for the past three years. Mr. A. N. M'Dougal said that prior to three years ago the valuation was £35. He pointed out that the Assessor had not made sufficient allowance for working expenses, and that in the case of Kinross the whole of the expenses of management had been allowed. In the Earlston case, he gave an abatement of 10 per cent. on £200 which a tenant would require to carry it on; but this was much too small a sum. He also allowed 20 per cent. of the tenant's profits, which left only £35 for the tenant. This meant that if a tenant were to take the works and employ a man to carry them on, he taking the oversight of the Company, his wage for the year would work out at £35. One man could not act as stoker, &c., and also as collector. He held that £95 would be little enough for his wage, and if he had to employ a man for the manufacture of the gas, there would only be £35 left as his wage. Besides, there was no allowance made for depreciation, nor for the accumulation of a fund for the renewing of plant. The £129 was not treated as profit. If it were divided up to the hilt among the proprietors, they would very soon have to put their hands into their own pockets. It would be a reasonable thing he thought for their Honours to consider what amount of this £129 was treated by the Directors as profit, and how much they divided. At 35s. a week, or (say) £70, it would be put mildly, and this without allowing anything for depreciation. In estimating the profits they must make allowance for depreciation. The return to the shareholders in this case was only £80 a year.

The Ayton Gas Company appealed against a valuation of £87, as compared with £40. The Company, he said, was the smallest among the gas companies; and this new method of valuation came much more hardly upon them than upon any of the others. In face of the Kinross case, they had to bow to the inevitable. The Secretary in the Ayton case did work which in a larger concern would be done in the manager's department. The concern was so small that the Manager was really a gas maker rather than a manager; and for the salary of ten guineas, the Secretary did the ordering of coal, paying the accounts, making out the gas bills, and so on. In certain cases one of his assistants helped the manager in the reading of meters. They held that £2 10s. might be taken as paying purely for secretarial work, and that £8 might be held as connected with the working of the concern. If their Honours were willing to put it on that basis, they would agree. If they called the Secretary by another name it would be passed, as it would go into practical working. The Assessor remarked that the Company had made £98 profit last year, the year before £118, the year before that £122, and the year before that £138. Mr. T. P. Doughty said they paid upon £40 in years when they had no profits at all, and he asked the Assessor to look farther back. The Assessor remarked that they had gone back ten years.

Their Honours retired to consider privately their decision, and were absent from the Court room a considerable time. On their return, the Chairman said the Court had decided to dismiss all the appeals.

Sandiacre Gas-Works Purchase.

As was recorded in last week's "Journal," the Long Eaton Gas Company are to take over the Sandiacre gas undertaking. The "Nottingham Express" states that the price agreed upon (which is regarded as mutually satisfactory) is £17,000—subject, of course, to confirmation by the Long Eaton stockholders at the meeting which will be held. The Sandiacre undertaking, our contemporary remarks, is the property of Mr. Hooley, and is one of those instances where a private person has been empowered by Parliament to supply a district. The works were originally for the supply of a mill; and as the village expanded, so did the works. Stapleford, though adjoining, if not actually embracing, the site upon which the gas-works stand, is supplied with gas from Nottingham; hut the district over which the Sandiacre gas supplying powers extend reaches right up to Long Eaton, and consequently to enable the Long Eaton Company to extend their operations in that direction it became essential for them to come to terms.

Gas v. Electricity for Library Lighting.

Last July, the legal proceedings instituted by the Lambeth Borough Council against the South London Electric Supply Corporation, Limited, in reference to the failure of the Company to carry out an undertaking made by them in 1897 to erect a dust destructor, were settled upon the following terms: (1) The Company to give to the Council free light (not power) to the extent of £1000 a year at the price of 3½d. per unit in public buildings, so long as the Order is held by the Company or their assigns. (2) The Company to wire—with fittings—the Council's libraries or other public buildings (excepting the Town Hall and Baths), making up the £1000 a year. (3) The Company to pay £300 towards the Council's out-of-pocket costs of the action. The matter was brought up again at the meeting of the Council last Thursday, when the Libraries Committee reported having had the arrangement under consideration. They suggested that in the first instance four named libraries should be wired and fitted for electric lighting; but that if the supply to the Baths and new Town Hall and such libraries should not reach £1000 a year, the Carnegie Library should be added. Otherwise, however, as the gas-fittings at the Carnegie Library were quite new, they thought gas lighting should continue there. There was, they said, one point which should be considered by the Council—the cost of electric lighting as compared with gas. It was believed that, even at 3½d. per unit, the cost of the electric light would largely exceed that of gas. The Committee did not consider that, under the circumstances, the Libraries Committee should be charged with a larger yearly sum for electric light to the general libraries than the amounts actually paid for gas; and they suggested that, to prevent difficulties and coufusion in the future, the Libraries Committee should be debited yearly with an amount equal to the average cost of gas at the several libraries during the three years ended March 31 last. The report was adopted.

Public Lighting of Merthyr Tydfil.—At their last meeting, the Merthyr Tydfil Town Council considered a recommendation by the Public Works Committee that the main road from Merthyr to Dowlais should be lighted by electricity instead of gas. The Gas Company offered to light the road by 68 single-burner lamps and 10 three-light lamps at a cost of £267 per annum; the single-burner lamps to be of 100-candle power, and the three-light lamps of 300-candle power. The Electric Company's offer was £3 per lamp for two-light lamps and £6 for four-light lamps—the Council to provide the brackets and supports. Alderman Jones, in moving that the matter be referred back, asserted that gas lighting was more efficient and certainly more economical; and he argued that, as the gas-standards had been fixed at the expense of the Council, it would be a great mistake to make an alteration—especially as they had no means of comparing the cost of the rival schemes. Mr. Daniel said it would be a suicidal thing to tie themselves to the Gas Company, who had never given any concessions except under compulsion and the threat of competition. The minute was, however, referred back to the Committee.

MISCELLANEOUS NEWS.

BRITISH COALITE COMPANY'S STATUTORY MEETING.

Chairman's Explanation of the Company's Position.

The Great Hall at Salisbury House, E.C., was crowded last Friday afternoon, in response to the intimation that the Statutory Meeting of the British Coalite Company, Limited, would then be held. In fact, there were many more shareholders than were able to find seating accommodation; while quite a number of Press representatives found themselves compelled to take their notes standing at the foot of the Directors' platform. Quite early in the proceedings, there were interruptions indicating dissatisfaction on the part of various shareholders—in view of the ticket system employed, it is fair to assume that they were shareholders—and these continued at varying intervals throughout the meeting. But it must be stated that applause was also frequently and freely indulged in.

The Report.

The report furnished to the shareholders in accordance with the provision of section 12 of the Companies Act, 1900, and dated the 7th inst., stated that the number of ordinary £1 shares allotted for cash was 750,182; while the total amount of cash received by the Company in respect of them was £269,084 9s. 7d. [It will be remembered that the number of £1 shares for which subscription was invited by the prospectus was 1,500,000.] The following payments had been made in accordance with the terms of the prospectus: Purchase consideration payable in cash, £55,000; underwriting commission, £45,000; purchase of freehold land at Wednesfield, £15,500; payments on account of freehold land at Barking, £20,740; expenditure at Wednesfield, £7799 17s. 2d.; brokerage, £803 11s. 3d.; payment on account of stamp duties, £77 10s.; furniture and fittings, £385. This made a total outlay of £145,305 18s. 5d. The preliminary expenses prior to allotment were borne by the vendors. The sums of £3500 for estimated stamp duties on conveyances and assignments, and £45,803 underwriting commission and brokerage were payable by the Company; and of these amounts, £45,881 had (as shown) already been paid.

Present Position and Future Prospects.

The proceedings were presided over by the Chairman of the Company (Mr. Albert G. Kitching, J.P.); and on rising, he remarked that the shareholders would doubtless expect from him, in addition to the report just referred to, some particulars with regard to the present position and future prospects of the undertaking. "A great many particulars," one shareholder impulsively interjected. With a large company of this kind, continued the Chairman, dealing with a novel business, three months was a short period in which to make any very great progress; but even in that limited time considerable advance had been effected. Perhaps it would be best for him to take the prospectus, and go through the various points in it. First as to the Directors, they were all practical men, with long experience in the special line of business with which they would have to deal; and their interest was identical with that of the shareholders. They had not sold the shareholders anything; they had not offered to sell anybody anything. They simply asked in the prospectus anyone who wished to do so to join them in buying something which they thought valuable—and that something was the British rights of an invention for making coal smokeless. The Directors believed it to be valuable then; and they believed it to be valuable now. They knew it to be a scientific success. They believed it would be a commercial success; and they believed it would be so now. With regard to the prospectus, they adhered to every particular therein; and if they had to write it again that day, the chief alteration that would be necessary would be to make the favourable points more favourable than they were then.

The Price Paid to the Inventor.

He had noticed, said the Chairman, some criticisms with reference to the price paid to the inventor. As to this, he could only say that he had seen many prospectuses in the course of his life; but he did not remember to have seen one in which the inventor or the concessionnaire received less than he did here, and he had seen a great many in which the price paid was vastly more. To his mind the conditions of purchase were honourable, fair, and reasonable. Practically, what took place was this: The inventor said: "I have after many years of arduous labour made a great discovery. [To this a shareholder unkindly queried, "Has he?"] You find the money, and we will divide equally the profit." He even went further, and gave them nine months to test the working and ascertain if the statements made were correct. More than this, he did not get one farthing until the shareholders had received 6 per cent. on their ordinary shares. The shareholders having shown their appreciation of this statement in a most unmistakable manner, by clapping of hands, the Chairman remarked that if any proprietor was not satisfied with these terms, he had better put his money into Consols, and never venture it in commercial undertakings.

The Agreement with Messrs. Cory and Son.

Passing next to the agreement with Messrs. William Cory and Son, the Chairman admitted that this had met with a very considerable amount of criticism. In explanation of it, he said there were a large number of different industries which they would perforce affect by their new process; and there were two alternatives before them—either to endeavour to work everything themselves, and consequently enter into competition with existing businesses, or to make an agreement with some influential firms which would ensure their co-operation. They selected the latter alternative; and what they had done as regarded the coal side of the question, they would prefer to do with reference to other interests—secure co-operation instead of competition. This remark also applied to the gas companies. Having regard to all the circumstances, he thought the shareholders would admit that it was highly politic to come to an arrangement with such a firm as Messrs. Cory and Son, and to enter into an agreement whereby the Directors instructed them to buy the coal for the Company at a small commission, and had a call on the firm's plant when they required it. Then as to the disposal of "Coalite." Here, again, they pursued the policy of endeavouring to carry the trade with them, and at the same time to protect themselves against any combination of hostile interests. They had therefore stipulated that Messrs. Cory and Son should first offer the "Coalite" to the regular coal merchants for them to supply to their private customers, so that there should be no monopoly and all would be on exactly the same terms. But if for any reason the merchants were not willing to encourage its sale, Messrs. Cory and Son would be prepared to market the "Coalite" themselves. The agreement relieved the Company of all responsibility with regard to the supply of coal and its transport, and at a cost at which they could not possibly do the work themselves; and they were also relieved of the disposal of the "Coalite" within the defined area.

The Estimated Profits.

This brought the Chairman to the question of the estimated profits, regarding which he remarked that, of course, with the amount of capital actually subscribed, they could not expect to earn the profits which were anticipated if the whole of the £1,500,000 had been forthcoming. But against this there would be the smaller amount of capital on which to pay dividend. Considering the extreme depression which existed at the time the Company was floated, and the attacks made upon them by a large and influential interest which feared their competition, it was a marvel to him that the shares were taken up to such an extent as they were. The Company had about 3500 shareholders; and he did not believe that any one of those who kept his shares would ever regret having invested his money in the undertaking.

The Validity of the Patents.

A point upon which the meeting manifested considerable curiosity was the Company's patents; and dealing with this, the Chairman remarked that, realizing from the first the great importance of the validity and effectiveness of the patents, the Board at an early stage had an independent investigation made on behalf of the Company. The result entirely confirmed the previous reports, and showed that the invention of "Coalite" was not only new, but formed what was known technically in patent practice as good subject-matter for a patent. The Company's patent position had been criticized in various respects. First, it was said that the "Coalite" invention was not good subject-matter for a patent; secondly, that a patent could not be obtained; and, thirdly, that even if a patent was secured, it would be wholly invalid and ineffective. Well, the application for a patent for the "Coalite" process had been examined by the English Patent Office Examiner, and a search made by him, with the result that not a single prior patent was found that anticipated the Company's invention. This was impartial testimony as to the novelty of the invention; and in respect to the equivalent patents in the United States and Germany—where the conditions were more stringent than here—the former had been granted and sealed, and the latter had been allowed. As to the second criticism that an English patent for the "Coalite" process could not be secured, their application had been taken through every stage up to publication; and acting under the advice of eminent Counsel, they had deferred the publication of the patent to the date allowed by the Patent Office for that purpose. Before coming to this decision, exhaustive searches were made, so that the Company's advisers were able to give an absolute assurance that the English patent would be granted as a matter of course, in spite of any opposition that might be raised by interested parties against the grant. As to the third point, that even if they secured the patent it would be invalid and ineffective, this was a kind of last resource of anybody who had to make criticism. It was very vague criticism; and he could only say that they were advised their patents would be effective, and that from his own knowledge he felt confident they would be successful in upholding them, and in effectively restraining infringement by any competitor.

What has been Done.

Coming to what has been done up to the present time, the Chairman said they were now completing the purchase of the freehold land at Barking, and taking possession. The assertion that the land was most conveniently situated, for some reason or other evoked laughter from one or two of the shareholders; and there were further signs of mirth on the Chairman remarking that, in addition to the Thames being on one side and the London, Tilbury, and Southend Railway on the other, there was a useful jetty, which would require "a little strengthening." Continuing, he said the Company had accepted tenders for a considerable number of stills; and delivery of these would be commenced within a week. It was anticipated that the first unit would be ready for work by the end of November. At Wednesfield, they had bought 60 acres of freehold land; and their plant was continuing to manufacture "Coalite" day by day. When they purchased the land, it was believed there was coal underneath; and an eminent colliery engineer who had gone into the matter now advised them that of the 60 acres, 40 acres could be worked for coal, which was what was called "Staffordshire thick seam," lying immediately adjacent to the surface. The quantity was estimated at over a million tons. The price of the land was £15,500; and it was admirably situated between the Midland Railway and the Wolverhampton and Birmingham Canal.

The Company's Product.

After explaining the method of manufacturing "Coalite," the Chairman claimed as one of its advantages that it was absolutely smokeless; and this led to the exclamation from the body of the hall, "So is coke." On this point, the Chairman said coke had never been widely used, because it was difficult to ignite, and required a strong draught to keep it burning, rendering it unsuitable for domestic grates; and, in addition, it contained only about 1 per cent. of volatile matter. "Coalite" contained from 12 to 13 per cent. of volatile matter—hydrogen compounds—which endowed it with properties of easy ignition and free burning, so that it could be lighted and burnt under exactly the same conditions as ordinary coal.

"Carbo" as a Competitor.

Attempts, said the Chairman, touching upon another matter, had already been made by certain gas companies to produce imitations of "Coalite." But the most cursory examination showed they had utterly failed to manufacture a smokeless fuel, and he did not think there was anything to fear from them. "There is one," remarked the Chairman, "or perhaps I should say was one, that was supposed by its parents to be so healthy an infant that they actually gave it a name, and called it 'Carbo.' Whether little 'Carbo' is growing up strong and active, I do not know; but the papers have ceased to record his progress to youth and manhood. It was the offspring of the Gaslight and Coke Company; and, curious as it may appear, it was born just the week before our prospectus was issued. It was advertised as smokeless fuel. Whether it can be purchased now—[A Voice: "Yes."]—I am glad to see they have sent some representative here—whether it can be purchased now, and whether it is silently but surely supplanting coal, I do not know. But from its appearance and all I can learn, I think that if this is the strongest competitor we have to fear, we need not pass one sleepless night."

Press Criticisms.

Attention was next bestowed by the Chairman to the criticisms that have appeared in the Press, most of which he admitted were fair and reasonable. Such criticism he welcomed. "I think," he said, "every Board of Directors is the better for it. Everything new inevitably encounters at first a great deal of prejudice. It is especially so in the case of new inventions; and I must confess that we appear to tread on so many people's toes that I do not wonder that we have been regarded by some with suspicion and with fear. But I am confident that the more our business is examined by those who fear our competition—more especially the gas companies—the more they will see that we come as friends, and not as enemies, and that we shall be mutually helpful one to the other." Referring to another kind of criticism to which he took exception, he said: "I do not mention the names of those almost unknown papers that have attacked us. It is probable they would think it an honour to be mentioned at a meeting of shareholders such as that I have the pleasure of addressing, and would regard it as a good advertisement for their worthless vapourings. I should probably have taken no notice of these at all if some anonymous post-cards had not been addressed to many of our shareholders. This I take to be a great impertinence, for the articles referred to were not only untrue, but in my opinion they were grossly libellous. My object in mentioning this at all is that you may judge what their advice is worth, and that some of our shareholders who have been alarmed may be able to decide whether these persons are likely to be more reliable advisers than the eminent scientific and professional men whose reports—not anonymous, but duly signed by them—appeared in our prospectus." After citing as those who had so reported Mr. James Swinburne, Professor Vivian B. Lewes, Dr. Samuel Rideal, Professor Robert Smith, Sir William Preece, and Mr. Thomas Parker, the Chairman asked whether all these men were fools, or whether it was more probable that the men making the attacks without signing them would merit that name.

Cost of Working.

Two other points fell to be referred to, both of which the Chairman said were of great importance to the future prosperity of the Company. Mr. Parker had during the past three months been giving his unremitting attention to cheapening and expediting the manufacture of "Coalite." For obvious reasons, he could not go into details at this moment; but he might say that Mr. Parker had been very successful, and that in the near future they might expect to manufacture "Coalite" more expeditiously and at less cost than had been mentioned in the prospectus.

Contract with a Gas Company Foreshadowed.

The second matter which he regarded as particularly satisfactory, stated the Chairman, was that the Directors had lately been in negotiation with an important gas company with a view to erecting plant on land close to their works. A shareholder asked for the name of the Company referred to; but the Chairman said he could not give it. Continuing, the Chairman explained that the idea was to sell the gas to the company at an agreed price. He was glad to inform the shareholders that they had practically concluded the agreement; there being only a few minor details to settle. They had told him that he would be absolutely correct in making to the meeting the following announcement: "Negotiations are now in progress, and will be completed in the course of the next few days with one of the most important gas companies in the kingdom for the erection of a plant to make 500,000 cubic feet of gas per diem on advantageous terms." They would retain and themselves deal with the "Coalite" and the other bye-products. He hoped and believed that this arrangement would be followed by many agreements of a similar nature. Concluding, he said: "We are quite satisfied with the progress we have made in the limited time at our disposal; and we have absolute confidence in the future of our undertaking."

Shareholders' Questions.

Various questions were put by shareholders on the Chairman resuming his seat. One asked whether it was true that the land at Wednesfield was purchased for £5065, and resold to the Company for £15,500; and whether Mr. Parker was the gentleman who carried this transaction through. If so, he did not think the shareholders ought to be put to the loss of something like £10,000. He had also been told that the price paid for the land at Barking—£850 an acre—was very high. A second shareholder asked whether "Coalite" had any of the sulphur which existed in coke, and said he felt more satisfied after hearing the Chairman's explanation of the state of affairs than he did before. Another wished to know whether the Examiner at the Patent Office required the insertion of any reference or references to a previous patent or patents; while a fourth gentleman expressed curiosity as to whether the underwriters had any shares to pay for.

Answering the questions, the Chairman said it was set out clearly in the prospectus that the Wednesfield Construction Company bought the land at Wednesfield for £5065, and afterwards sold to the Company for £15,500. The rise in price, he took it, arose from the strong conviction that there was coal under it. At any rate, it was a good purchase for the Company. At Barking, there were a great many owners concerned, and they all had to be dealt with. The Company were assured that the land was worth what they had paid for it. "Coalite" was practically free from sulphur, but not absolutely. The answer to the query as to whether the Patent Office Examiner required the insertion of any reference or references to a previous patent or patents, was, "None whatever." The underwriters had to take up some of the shares; and they had paid a very large sum of money already. He had no doubt they would pay what more was required.

The Chairman was thanked for his services; but before this point was reached, the shareholders had related to them by one of their fellows the troubles of a gentleman who in a moment of enthusiasm ordered five bags of "Coalite." These were delivered to him by Carter, Paterson, and Co., with a demand for 9d. per bag carriage, which the would-be consumer declined to pay. What became of the "Coalite" did not transpire.

HOBART GAS COMPANY.

The report presented at the half-yearly meeting of the Hobart Gas Company, which was held on Aug. 7, stated that the balance at the credit of profit and loss account was £6404, less at debit of electric light account £357, leaving a net amount of £6047, from which the Directors recommended the payment of a dividend of 16s. per share, amounting to £4400, and the allocation of £750 to the reserve fund. Deducting these sums, and £220 for dividend tax, there would be a balance to carry forward of £677. New settings of retorts were charged with coal for the first time on May 9; and the carbonizing returns since that date showed a marked improvement—justifying the expenditure.

The Chairman (Mr. John Hamilton), in moving the adoption of the report, said the period covered by it had been a busy one in connection with reconstruction work and extensions of the mains. The new regenerative settings of retorts had been put into operation; and the results obtained were in every way satisfactory, and reflected credit upon the various contractors who supplied the plant, and especially upon their Consulting Engineer (Mr. P. C. Holmes Hunt) for the care and attention to details bestowed by him in preparing the drawings and specifications. The work of erection had been almost entirely carried out by the Company's own staff. The most profitable business to cultivate was, he held, additional consumption by present consumers. The average consumption per meter with their Company compared very unfavourably with that in the provincial towns in England and cities of a similar size in Australia and New Zealand. As the shareholders were aware, the Board last year reduced the price of gas used for cooking purposes; and it had been the practice for many years past to hire out gas-stoves at a small rental, fixing them free of cost to the consumer. They were now reaping the benefit of this policy. The number of stoves sent out from store last half year exceeded that of any similar period. They had also established a separate department for maintenance of incandescent burners. The sales of gas disclosed a steady increase; while the electric light business also showed a marked improvement. During the past half year (on March 9) the Company had reached their jubilee of gas lighting; and the occasion was celebrated by a dinner to the officers and workmen.

The report was adopted, and the Directors' fees were increased.

SIR GEORGE LIVESEY ON TRADE UNIONS.

The Threatened Railway Strike.

Writing to the "Daily Mail" on the subject of the agitation now being fostered by the Amalgamated Society of Railway Servants, and the possibility of a resultant strike, Sir George Livesey says the question arises whether it should be in the power either of the Railway Companies or the Union to stop all railway traffic, to the untold loss and danger of the public. In trades in which Unions are officially recognized, a strike or lock-out may not involve loss or danger to the public; but herein lies a complete and radical difference between these concerns and a railway or a gas company, in which a stoppage would be disastrous to the public. The parliamentary obligations of these public companies are prohibitive of a lock-out. Therefore a strike should be equally impossible, and for the same reason—that it is against the public interest. Parliament, however, while protecting the public against a lock-out, has failed to give the equally—or, in fact, more—necessary protection against a strike in the case of a railway company, though it is given to gas and water companies by the Conspiracy and Protection of Property Acts.

Continuing, he says: "Now let me ask whether it should be in the power of thirteen unknown, irresponsible railway workmen, who form the Committee of the Amalgamated Society of Railway Servants, with their Secretary and Assistant-Secretary, to stop all the railways in the kingdom—which they seem to be willing, and some of them, at least by Mr. Bell's official statement, anxious, to do at once. An immediate strike, however, would so utterly alienate public opinion that they dare not declare it, but have for the moment shunted the responsibility on to their members. But responsibility cannot be shared by 100,000 men—many of them Socialists—who will vote individually, as they are personally advised or inclined, with no sense of responsibility to the public. The Union put itself out of court by ever talking about a strike; and now, having converted the talk into a threat, the responsible heads of the Railway Companies have had a clear intimation of what recognition would mean. They now know that the Society would not hesitate, for the attainment of its own objects, to paralyze the whole trade of the country. The railway authorities realize their responsibility, as is shown by their refusal to recognize the Union; and the public should feel thankful that its interests are in such safe hands, rather than at the mercy of the irresponsible Committee and members of the Amalgamated Society of Railway Servants. My sympathies have always been with working men. I desire, in President Roosevelt's noble words, 'a righteous peace in the industrial world.' But it is not coming by way of Trade Unions. Recognition of this Union by the Companies would seriously retard its advent, for it can only come by direct dealings between employer and employed."

STOCKPORT CORPORATION GAS SUPPLY.

Report by Mr. S. Meunier.

In his sixteenth report to the Gas Committee, dealing with the operations of the Stockport Gas-Works during the year ended March 31 last, Mr. S. Meunier, the Gas Engineer, says that, though the profits, both gross and net, apparently appear to be the highest ever obtained in the history of the department, yet this is not so as regards the net, because the alteration with reference to interest and sinking fund and the equation of loans, which this year, and for the first time, have been placed to the credit of the accounts, are accountable for £4041 of the total of £17,412; so that the year 1895 still holds the record—the price of gas, however, being then rather higher. The gross profit for the year is £34,251, as against £29,735 in the previous one.

The total income was £109,863, or an increase of £4350, of which gas sales accounted for £3103; the quantity of gas accounted for being 742,830,000 cubic feet, as against 710,849,500 cubic feet, or an increase of 4·5 per cent. Coke, which up to November and December, 1906, was a stagnant market, revived enormously during tho last three months of the financial year, with the result that what on Dec. 31 showed a decreased income, finished up with an actual amount of £1853 to the good. Tar and cyanide also showed some slight advance; while ammoniacal liquor again exhibits a falling off. While the expenditure on manufacturing shows a slight increase, both in the coal and carburetted water gas, this only represents on both £992. The make per ton (10,888 cubic feet against 10,756 feet) is, however, 132 feet higher, and the unaccounted-for gas for the year is reduced by 0·62 per cent. (5·13 per cent. against 5·75 per cent.). The item of maintenance shows a decrease of £1399, mainly brought about by the fact that the new installation of inclined retorts being in progress, many of the usual repairs to the old plant, which would otherwise have had to be carried out, were rendered unnecessary. This, of course, is a saving which may not occur again to the same extent. In addition, the work at Heaton Lane was kept down as much as possible, as the new extensions will enable all the gas required over the next two or three years to be entirely generated at Portwood, with, it is anticipated, a saving both in cost and trouble. The question of the future of the Heaton Lane works should be taken into careful consideration, as, with the greatly increased output, its size and the additional costs incurred by working it militate against obtaining economical results. At the same time, the whole question of future requirements and the utilization or otherwise of the land at Portwood Drops might be taken in hand, as the present productive capacity (not including the Heaton Lane works) will be taken up in from five to six years, and the preparation of plans, obtaining powers, and carrying out of extensions will take at least two or three years. There has also been a saving of £668 on distribution, arising principally in the item of maintenance; the same amount of work on mains and services as during the previous year not having been found necessary. Meter fittings and stoves show an additional expenditure of £829, due principally to stoves; the Committee's arrangements to fix these free having brought increased business in, with consequent additional work.

The reserve fund on March 31 stood at £6355. But from this will require to be paid during the coming year various sums on capital expenditure, for which the Local Government Board would not grant powers. In addition, the retort-house roof at Portwood will require overhauling, and at the same time slightly altering, in order to add to the comfort of the workmen on the new inclined settings. Thus it is anticipated very little of this sum will be left at the end of the next financial year. Attention is again asked to this important fund, so that it may be made up to withstand, at any time, any large and exceptional expenditure, which would otherwise have to fall upon the revenue account in any one year. Since installing the Livesey washer to work Mr. Colson's process for the prevention of naphthalene, little or no trouble in respect of this has been met with; while the cyanide washer has also been altered by the makers, at their own cost, and brought into good order. The new system of inclined retorts was also completed during the year, and is now in use. Various little difficulties, inseparable from the commencement of a new system on a large scale, have been met with, but are being gradually overcome. Once the workmen are thoroughly accustomed to the plant, no further difficulty is anticipated. The new boring in the bottom of the well for works water has turned out very successful. The Pelouze and Audouin tar-extractor at Portwood was removed from the inlet to the condensers to the inlet of the cyanide washer, with greatly increased efficiency and economy of working. The latter is shown by the fact that only eight changes of purifiers were made during the year, as against twenty-four the previous year—the saving of this in wages being about £200. A temporary stove repairing and cleaning shop has been fitted up and brought into use, greatly reducing costs. In fact, the work has been so greatly expedited that the plant has also been utilized for cleaning meters, lamps, and other portions of the general apparatus.

The outlook for the ensuing year, taken on the whole, is fairly bright. On the one side, the price of coal has been raised over 2s. per ton, and new contracts which had on the completion of the old to be made for tar and liquor, unfortunately, could not be renewed on as good terms as previously. Yet the additional cost on the one hand, and the diminished revenue on the other, will, it is thought, be recouped by savings in cost of manufacture by the new plant and the anticipated better market for coke, the price of which is considerably higher than at this time last year, while the stocks throughout the North of England are, for the corresponding period, many thousands of tons less. In addition, the sales of gas continue to increase in a satisfactory manner, especially during the summer months—pointing evidently to the gradually increasing use of various types of heating appliances during hot weather.

Tables appended to Mr. Meunier's report show that the number of meters in use is 27,682, of which 10,223 are prepayment. The quantity of gas made during the past year was 782,526,000 cubic feet; the amount accounted for being 742,830,000 feet. The largest make in 24 hours was 3,772,000 feet, and the largest delivery 3,879,000 feet. The make of gas per ton was 10,888 feet, and the illuminating power 17·40 candles. The leakage amounted to 5·13 per cent. A sum of £96,073 was received for gas, including public lighting, as against £92,314 for the preceding twelve months. During the year, 6019 tons of cannel, 48,558 tons of coal, and 529,979 gallons of oil were carbonized; the residuals made for sale being: Coke 25,091 tons, tar 3694 tons, liquor 6145 tons, and sulphocyanide 89,070 lbs. At March 31, the capital account stood at £246,652. On revenue account there was an income for the past year of £109,862, and an expenditure of £75,611; the gross profit being £34,250, or 13·88 per cent. on the capital. Interest absorbed £7758 and sinking fund £8494, leaving a net profit of £17,412, or 7·06 per cent. on the capital. Of this, £13,000 was appropriated to the rates, £4312 was placed to reserve, and £100 to insurance. The price of gas is now 2s. 6d. per 1000 cubic feet within the borough, and 2s. 10d. outside, less 2d. per 1000 feet discount. Differential discounts are allowed on gas used for industrial purposes, up to 10d. per 1000 cubic feet.

HALIFAX CORPORATION GAS UNDERTAKING.

The Past Year's Accounts.

The accounts of the Gas Department of the Halifax Corporation for the year ended the 31st of March last show that the total revenue was £114,243, compared with £113,026 for the year 1905-6; while the expenditure was £71,522, against £76,077—leaving a gross profit of £42,721 compared with £36,948. The sale of gas to ordinary and prepayment consumers produced £85,534; while gas used for street lighting figures for £7299, and for public purposes and trading concerns for £1467—making a total of £94,301. But against this there was a sum of £334 paid to the Sowerby Bridge Urban District Council for gas supplied to Luddenden, and another of £8760 for discount, &c.—bringing it down to £85,206. Meter-rents came to £2220; and residuals yielded £24,850. Various other items brought up the total to the amount stated above. On the expenditure side, the manufacture of gas (coal and water) came to £39,737; purification to £220; maintenance to £11,184; distribution to £6842; management, &c., to £4723; and rates, to £6461. The balance of £42,721 brought from revenue account, with a sum of £1515 on sundry accounts, is thus disposed of: Interest, &c., £19,511; sinking funds, £8412; income-tax, £917; balance, £15,175. The last-named amount added to the balance of £11,608 brought forward made a total of £26,784, out of which £5652 is transferred to the borough fund and £2826 to the district fund in relief of rates, leaving an unappropriated balance of £18,305.

Following the financial details is an analysis of the cost of gas for the years ended March 31, 1906 and 1907. The net cost of coal last year came to 1·89d. per 1000 cubic feet of gas sold, against 1·77d. before; and the total cost at the works to 14·99d., compared with 14·71d. The net cost outside the works was 5·63d., against 5·63d.; the total cost, 20·59d., against 20·34d. Adding 0·07d. for the accident insurance fund, brought the 20·59d. up to 20·66d., leaving 4·47d. as the balance of profit. At the end of March, 1906, the total cost, as already stated, was 20·34d.; the accident insurance fund came to 0 08d., deficiency on tar-works to 0·39d., the profit to 4·38d., and the total receipts to 25·19d. The gas sent out in the twelve months covered by the accounts was 867,034,000 cubic feet, of which 814,492,300 cubic feet were sold and 10,616,000 cubic feet used on the works. In the year 1905-6, the figures were: Gas sent out, 874,251,000 feet; gas sold, 797,441,800 feet; gas used on the works, 10,304,700 feet. The leakage has been reduced from 7·59 per cent. in 1905-6 to 4·82 per cent. in 1906-7. The price of gas is 2s. 3d. per 1000 cubic feet within the borough, and 3s. 1d. beyond the borough boundary, subject to a scale of discounts of 8⅓ to 17½ per cent. (equal to a reduction of 2¼d. to 4¾d. per 1000 cubic feet). Gas supplied through prepayment meters is 2s. 9d. per 1000 cubic feet net, inclusive of free loan of meter and cooking stove.

GAS AND WATER ADMINISTRATION AT BARRY.

Engagements of the Engineers to Terminate.

The question of the management of the Barry gas and water undertakings, which has occupied a considerable portion of the time of the Urban District Council during the past two or three months, was again discussed at the monthly meeting on the 10th and a special meeting on the 17th inst. Last July, on the recommendation of the Gas and Water Committee, it was decided to place the two departments under one Manager, and to terminate the engagements of the Gas Manager (Mr. F. M. Harris) and the Water Manager (Mr. E. W. Waite); but at the conclusion of the meeting (*ante*, p. 341), notice was given by Mr. Hogg to move the rescission of the Council's resolution approving of the recommendations of the Committee.

Accordingly at the meeting on the 10th inst., Mr. Hogg proposed that the resolution should be rescinded; while there was also a somewhat similar motion on the *agenda* in the name of the Rev. Ben Evans. Mr. Evans was not able to be present; but Mr. Hogg introduced his own motion, which he said would enable the members to retrace a step which reflection must have shown them to be hasty and unwise. The Council evidently had confidence in the justice and ability of Mr. Porter to report upon the undertakings, and some of them had read the startling statements of that gentleman; but only a few had digested them. At a special meeting of the Gas and Water Committee, when there was no discussion upon dual management—no single word of explanation or argument—it was proposed to place both undertakings under one head, in direct opposition to the views of Mr. Porter. A largely attended public meeting decided unanimously in favour of further inquiry; but on the following night, despite the views of the ratepayers, the Council, again without reason or argument, confirmed the action of the Committee, without giving the Engineers an opportunity of saying a word in defence of any charges that might be formulated against them. Was this a fair and reasonable method of dealing with old public servants? The public outside, with no opportunity of

judging, must conclude that there was something, presumably of a scandalous nature, too bad to be put into words, or the Council would never act in such a drastic manner. He, personally, had never heard any definite charge in the Council Chamber. Of course, there were rumours in the streets of mistakes in years gone by, and of the extravagant expenditure of previous Committees; but he boped the time was far distant when the Council would transact tbeir business on street corners or in back parlours. They had been deliberately told that if the charges were made public they would damage the Engineers in their professional capacity; but what could possibly do them greater injury than the things which the dismissal carried with it? A single-man management would be a costly mistake; for they rarely found a man who was a specialist in two things. It really seemed as if there was an attempt to get rid of the two Engineers at all costs, and to deprive the officials of an opportunity of defending themselves. The Chairman (Mr. W. J. Williams, J.P.) seconded the resolution, feeling that justice had not been meted out to the two officials; but it was lost by fifteen votes to three.

Mr. Hogg then moved the resolution standing in the Rev. Ben Evans's name—"That the Gas and Water Committee be requested to state their reasons for recommending the dismissal of the two Engineers; and tbat no further action be taken until those reasons, and the Engineers' reply thereto, have been received and considered by the Council." He had heard, said Mr. Hogg, within a short public life, references made to a conspiracy of silence; but never before bad he had such an exemplification of it as that evening. When eleven members who did not know what had taken place were content to vote in favour of sending these men about their business without opening their mouths, he did not know how to stigmatize their conduct. He could understand it if arguments and charges had been made and responded to; but when no word was said or a blow struck, he did not know what to think. But he did expect the Chairman of the Gas and Water Committee to say something to justify their action. What could be at the bottom of it all and in the background of the minds of these men, he knew not; but if they were on the Exchange, or anywhere else, they would not exist as business men for ten minutes. In the very face of their expert, they were tearing up his report, and going in direct opposition to his suggestions. His ideal of the Barry District Council had been shattered; and the pleasure with which he looked forward to transacting business at that table had disappeared. He had been led to believe that a high moral tone pervaded the Chamber, that there was nothing underhanded, and that everything was above board; but he repeated that his ideal had fallen, and things were not what they seemed. The Chairman again was the seconder; but this time the resolution was lost by fifteen votes to two. The Clerk thereupon asked for instructions regarding tbe notices; and the matter was referred to the Gas and Water Committee—a special meeting of the Council to be called should any difficulty arise.

A week later a special meeting was held to consider the minutes of the Gas and Water Committee in connection with the matter. The Committee recommended that the Engineers should be given six months' notice; their engagements to terminate on March 31, 1908. Mr. Watson asked if there was any agreement by whicb the Engineers were entitled to 2½ per cent. on all new work. The Chairman said Mr. Harris had never spoken about any agreement. After further talk, the Rev. Ben Evans moved, as an amendment to tbe Committee's recommendations, that the question should be deferred until the Council bad framed any accusations they had to make against the Engineers. He candidly confessed tbat he did not know why the officials were being dismissed. If, he said, the idea got abroad that these two men were unfairly treated, the Council would have no little difficulty in finding a capable successor. Naturally, there would be plenty of applications; but not from first-class men. He believed very strongly that the Engineers sbould be allowed an opportunity of answering what accusations there might be; and while be had no objections to tbe reasons being given in private, he would prefer to see everything as open as possible. If the men were inefficient, he would be one of the first to approve of giving them notice. Mr. Hogg having seconded, Mr. Manaton said he was sorry some of the other members had not spoken; but knowing what had taken place at recent meetings, he was not surprised at it, and he thought the Committee were very wise in keeping silent. When the report of Mr. Porter was being considered, he remembered Mr. Harris telling the Chairman of the Gas and Water Committee that if anything derogatory was said about him (Mr. Harris) he would make them pay for it—or words to that effect—and that a certain gas manager, who had been interfered with by a chairman of another gas and water committee, had obtained damages to the extent of £800. The amendment was lost on a vote being taken.

GREAT YARMOUTH GAS COMPANY.

A Souvenir.

In connection with the sale of new shares which (as duly announced in the advertising columns of the "JOURNAL") is to take place next Thursday, mention may be made of a nicely got-up and profusely illustrated souvenir of tbe Great Yarmouth Gas Company, a copy of which we have received. The whole business of the undertaking is dealt with, from the works to the burner; and the process of gas making is rendered clearly understandable by the uninitiated. From the pamphlet we have extracted the following particulars.

The gas lighting of Great Yarmouth was inaugurated in the year 1824, when Mr. G. S. Palmer, who was known to our grandfathers as the vendor of tar, which, in their days, was known as "Palmer's paint," contracted with the Paving Commissioners to supply the town with the new illuminant of those days. It was not until 21 years later (1845) that a Company was formed for the purpose of carrying out existing contracts or arrangements with the Commissioners under the Act of the 50th year of King George III. (1810), and for making and executing any similar contracts or arrangements with the Commissioners, for lighting the streets, highways, lanes, passages, &c., with coal gas. In 1863, the Company was incorporated by a Special Act of Parliament; and from that time onward much progress was made in the development of gas lighting, which proceeded with the continuous enlargement of the works, purchases of land, and other important matters. It was at this period of the undertaking's history that the sterling qualities of the then Secretary and Manager of the Company were specially marked. The late Mr. W. H. Willis earned the profound respect and confidence of the Directors of the concern by his hard work, consummate tact and skill, and success in administering the Company's interests during this critical and important time. As time went on, Mr. J. H. Orde succeeded as Chairman Mr. Thomas Brigbtwen, on that gentleman's decease; and he was followed by the late Mr. G. S. Shingles, at wbose death the position was taken by the present Chairman, Mr. R. H. Inglis Palgrave, who has conducted the affairs of the Company for practically the past twenty years.

The coal used by the Company is derived from the collieries of the Marquis of Londonderry, at Seaham Harbour, and produces an excellent coke. For many years the coal supply was sbipped in sailing vessels of small tonnage; the coal being delivered into hundredweight bags and carted to the Company's stores. As the requirements of the Company in this direction increased, however, it became more and more evident that new methods of handling the coal needed to be devised. Mechanical contrivances have now been adopted, not only to cheapen the cost of delivering and storing the coal, but to expedite the discbarging of the collier steamers—a most important point at those times when the harbour is congested, and the quay space most valuable. Incidentally it should be stated that the Company, at considerable expense, arrange to store extra quantities of coal during certain months of the year; and by receiving no steamers in November, they assist the Fish-Wharf Committee of the Corporation, as far as possible, in their difficult task of finding berthing accommodation for the boats engaged in the herring trade. The crane employed to lift coal out of the steamers is actuated by hydraulic power at a pressure of 750 lbs. per square inch. Having deposited the fully-loaded coal-skip into a vehicle designed expressly to prevent anything like a dust nuisance, it is carted to the works, passes over a weighbridge, and is tipped into a hopper to be elevated, crushed, and delivered mechanically to a conveyor-belt running along the whole length of tbe coal-store. From this conveyor it is thrown off by mechanical means, at any desired point, and in such a manner as to be practically self-trimming; thus reducing the labour bill to a minimum. The coal dealt with in this way amounts to between 16,000 and 17,000 tons per annum; but the plant is comprehensively constructed to handle many times that volume—40 tons per bour, in fact, being its capacity. After being deposited in the coal-stores, there are mechanical elevators arranged to place the coal in compressed-air retort-charging machines. The coal is delivered into 20-feet retorts in a perfectly even layer, by an arrangement patented by Mr. W. J. Carpenter, tbe Engineer and Manager of the Company,

The retorts are in benches of eight, heated by regenerative furnaces, which are the production of the Engineer and his staff; and all the work is executed by the Company's retort-setters and workmen.

After a description of the process of gas making, the following figures are quoted to show the Company's progress:

Gas Produced.

Year.	Cubic Feet.
1886.	104,559,000
1896.	127,625,000, 22 per cent. increase
1906.	166,938,000, 30 ,, ,,

Tbis shows a grand increase in the past twenty years of nearly 60 per cent. in the quantity of gas produced. The output in 1907 to date exceeds all previous records.

A section is tben devoted to the distribution department, showrooms, offices, workshops, stores, &c.; it being pointed out that in every particular the Company undertake the sole responsibility of the distribution of the gas from the works to the consumers' burners. The maintenance system in operation is found to give every satisfaction. The Company, in lighting and extinguishing tbe public lamps, divide the town into eight sections; and each has its own lighter. By this system, the various important business districts of the town are lighted simultaneously; and as the reverse order is used in extinguishing, the principal parts are accordingly benefited.

Dearer Gas at Bridgwater.—The report of the Directors of the Bridgwater Gas Company for the year ended June 30 states that the net profit amounts to £3904, to which has to be added the sum of £828 brought forward, making a total of £4732. Interim dividends at the rate of 10 per cent. per annum on the "A" stock and 5 per cent. per annum on the "B" and "C" stock were paid for the first six months; and there is a balance of £3107 now to be dealt with. The Directors recommend the payment of dividends at the same rate as the interim ones, which will leave a balance of £1482, out of which it is proposed to carry £650 to the reserve fund, and the balance of £832 to the credit of next year's accounts. Considerable extensions of mains have taken place during the past year; and the Company's business has expanded very largely. To deal with the increasing business, further capital is necessary; and the sanction of the stockholders is to be sought to the raising of a sum not exceeding £6000 in debenture stock. The output of gas again shows a satisfactory increase—being 2,658,000 cubic feet more than the previous year. The sustained rise in the cost of coal has given the Directors much anxiety; and as they were only able to renew contracts at prices considerably in advance of those of last year, they have most reluctantly been compelled to announce an increase in the price of gas of 2d. per 1000 cubic feet, to take effect from Oct. 1. The Board deeply regret the death of their late colleague, Mr. G. B. Sully, who for 48 years had been connected with the Company. The vacancy thus caused in the directorate has been filled by the appointment of the Company's late Manager, Mr. J. H. Cornish, for the remainder of Mr. Sully's period of office.

MUNICIPAL ELECTRIC LIGHTING.

An Accountant's Report on the Barnstaple Undertaking.

A report upon the accounts of the Barnstaple Corporation electricity undertaking from its inauguration in 1902 to March 31, 1907, has been prepared by Mr. Hubert Leicester, chartered accountant, and circulated among the members of the Town Council. Accompanying the report are three tabulated statements in which the accounts are analyzed. One of these is a revenue account for the whole period of the undertaking's history, showing a loss (exclusive of the losses on the installation) of £1830. This includes a sum of £270 improperly charged to capital account. A noteworthy feature of this account is that, of the total income of £13,445 from sales of current, no less than £6330 has come out of the rates for public lighting. In another account Mr. Leicester gives the capital expenditure, which he finds, after the deductions of certain sums not properly chargeable under this head, comes to £31,165. The remaining statement is a balance-sheet to March 31 last, showing that there was due to the Treasurer at that date on revenue account the sum of £3017, as against which must be set certain accounts outstanding and stock in hand amounting to £1187; leaving the net loss at £1830. Mr. Leicester recommends that this sum should be reimbursed to the electricity undertaking from the rates, and that steps should be taken to obtain a loan for the amount (£294) due to the Treasurer on capital account.

In his report, Mr. Leicester first refers to the transfer of certain items of expenditure from the capital to the revenue account, and says that the Electrical Engineer agreed with him, on having the matter brought to his notice, that it would have been more correct to have charged several of the items to different accounts. Upon this point, Mr. Leicester adds: "There is a general opinion in connection with municipal accounts that the true test as to whether an item should be charged to capital is, whether the Local Government Board have sanctioned a loan therefor. In my opinion, this is not conclusive evidence, in trading concerns carried on by municipalities, that the items can safely be charged to capital. Where they are so charged, certain points must be considered which materially affect the welfare of your electricity undertaking, and which it is therefore advisable to bring to your notice." Another paragraph in this section refers to the public lighting. "With reference to the amounts charged to the Corporation for repairs, &c., in connection with the public lighting," says Mr. Leicester, "it would appear (if the Corporation pay to the electricity department the sums outstanding against them at the 31st of March last) the undertaking will have made a profit under this heading of £103. Part of this is accounted for by the fact that there is a stock on hand, in connection with the public lamps, amounting to £83; and if this stock is used upon the public lighting without making any further charge against the Corporation, the profit would then amount to £20. But there is danger that when this stock is used in repair and maintenance of public lamps, it may again be charged to the Corporation."

On the subject of depreciation, Mr. Leicester makes the following observations:—

In the accounts dealt with, no provision has been made for depreciation on capital expenditure, excepting the amount set aside annually out of revenue for the repayment of loans according to the requirements of the Local Government Board. This amount is calculated so as to exhaust each loan at the end of its prescribed period. Now electrical plant and machinery depreciate with notorious rapidity; and in many cases it happens that at the end of about ten years or less, a specific piece of machinery becomes absolutely valueless and has to be replaced, while the loan raised for its purchase remains to be paid off during the succeeding years. It may also occur that a fresh loan is granted to replace the machine—one asset thus representing two loans. Bearing these facts in mind, it will be seen that the question of depreciation becomes of great importance. In the following list, the capital expenditure is divided under its various headings, and against each is placed the percentage of depreciation which, in my opinion, should be annually written off the asset and charged against revenue: Buildings, 2 per cent.; machinery, 10 per cent.; accumulators, 10 per cent.; mains, 4 per cent.; meters, 10 per cent.; instruments, 10 per cent.; stores, 10 per cent.; preliminary expenses, 20 per cent.; office furniture, 10 per cent.; water supply, 10 per cent. The total capital expenditure to March 31, 1907 (after adjustment), amounted to £31,165. One year's depreciation, at the percentages suggested above, works out at £2170, while the total sum set aside for repayment of loans from 1903 up to March 31, 1907, only amounts to £2704, equal to £676 per annum. This, it must be remembered, forms the only existing provision for depreciation of any kind. These figures of depreciation are based upon the most careful investigation of the capital expenditure and upon the probable life of each asset. They are the result of much consideration and experience, and are approved by your Electrical Engineer.

Having thus indicated the requirements of the undertaking, if the Corporation are to meet their future liabilities, Mr. Leicester proceeds to point out that the question of depreciation is one which goes to the root of municipal trading conducted on business lines. He says:

Now the above statements are made in the full knowledge that it is not the custom of many electricity undertakings to make any provision for depreciation other than that required by the Local Government Board. This is merely a provision for an annual instalment sufficient to clear off the loans for capital expenditure at the end of the periods allotted to them. In pursuing your present policy, therefore, you are merely following the example of almost every other municipal authority in strictly adhering to the Local Government Board regulations. The measures necessary to fulfil legal requirements, however, fall far short of those necessary in order to conduct a trading undertaking on business lines, so that at least it may not be a burden to its proprietors. The latter, it is presumed, is the object with which your electricity undertaking was installed, and it is therefore highly advisable that the above facts should be placed before you for your serious consideration. If you decide to continue the undertaking without an adequate system of depreciation such as is recommended above, it is feared that before many years have elapsed you will find the borough burdened with an ever-increasing debt caused by the replacement of worn-out capital assets, and necessitating a heavy call upon the rates each year to meet the deficiency resulting from increased interest and instalments of loans. It may be asserted with confidence that it is owing to the neglect of principles such as those here advocated that many municipal trading undertakings are now in serious difficulties, and it is my opinion—an opinion based on much study and wide experience—that it is only by the adoption of such principles that you can hope to make your electricity undertaking a permanent financial success.

In conclusion, Mr. Leicester points out that the cost of production is very high compared with other works, and recommends that consideration should be given to "any scheme that would make electricity more popular with consumers" so as to reduce the average cost of production.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 817.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.. . . .	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4¾—5¼	..	5 6 8
50,000	10	Aug. 29	14	Bourne-mouth Gas and Water 10 p.c. . .	27½—28½	+½	4 18 3
51,810	10	,,	7	Do. B 7 p.c. .	16½—17	+¼	4 2 4
53,200	10	,,	6	Do. Pref. 6 p.c.	14½—15½	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	247—252	..	4 19 2
300,000	,,	,,	9½	Do. New . . .	185—190	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref. .	115—120	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb. .	10[illegible]—10[illegible]	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk. .	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	116—119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c. .	87—90	..	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
150,000	20	July 12	8¼	Cagliari, Ltd.	26½—27½	..	6 0 0
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.. .	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug 15	5	Chester 5 p.c. Ord. . .	106½—108½	..	4 12 2
1,443,280	Stk.	,, 29	5 2/10	Commercial 4 p.c Stk. .	101—106	..	4 18 1
560,000	,,	,,	5	Do. 3½ p.c. do. .	98—103	..	4 17 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	138—143	+2	4 17 11
460,170	Stk.	—	5½	Derby Con. Stk. . .	123—125	..	4 8 0
55,000	,,	—	4	Do. Deb. Stk. . . .	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd. . . .	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17½—18½	..	4 17 4
15,181,590	Stk.	Aug. 15	4 4/10	Gas-light and Coke 4 p.c. Ord. . .	93—95	..	4 12 7
2,600,000	,,	,,	3½	Do. 3½ p.c. max. . .	86—88	..	3 19 7
3,799,735	,,	,,	4	Do. 4 p.c. Con. Pref.	104—107	+1	3 14 9
4,193,975	,,	June 13	3	Do. 3 p.c. Con. Deb.	81—83	..	3 12 3
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	93—95*	..	5 2 0
82,500	,,	,,	6½	Do. do. 5 p.c.	114—117*	..	5 11 1
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental .	174—176	..	4 10 11
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93	..	3 15 3
195,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c. .	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A . .	220—222	+2	4 10 1
718,100	,,	,,	7	Do. B. .	160½—161½	..	4 6 8
152,736	Stk.	Feb. 14	7⅝	Maidstone 5 p.c. . .	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of Melbourne 5 p.c. Deb..	101—103	..	4 17 1
250,000	100	,,	4½	Do. 4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	May 30	3⅓	Monte Video, Ltd. . .	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	107—108	..	4 5 7
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19—20	..	5 0 0
55,940	10	,,	7	Do. 7 p.c.	12½—13½	..	5 3 8
300,000	Stk.	Apl. 26	8	Oriental, Ltd. . . .	140—145	..	5 10 4
60,000	5	Sept. 13	7	Ottoman, Ltd. . .	5¾—6¼*	..	5 12 0
398,490	5	May 15	7	Primitiva Ord. . . .	6¾—7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref. .	5—5¼	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb. .	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord. . . .	13—13½	..	5 18 6
312,650	Stk.	June 27	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd. . . .	13—13½	..	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb. .	48—50	..	5 0 0
135,000	Stk.	Sept. 13	10	Sheffield A	242—244*	+1	4 2 0
209,984	,,	,,	10	Do. B	242—244*	+1	4 2 0
523,500	,,	,,	10	Do. C	242—244*	+1	4 2 0
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	119—121	..	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Sept. 13	8	South Shields Con. Stk.	155—157*	..	5 1 11
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	115—118	..	4 13 3
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	117—120	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord. . .	105—110	..	4 10 11
120,000	Stk.	Aug. 15	6¾	Tottenham and Edmonton A 5 p.c. .	120—123	..	5 9 9
398,910	,,	,,	5¼	Do. B 3½ p.c. .	100—103	..	5 1 11
149,470	,,	June 27	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 13 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth and Putney A 5 p.c. . .	—	..	—
255,636	,,	Aug. 15	6½	Do. B 3½ p.c. . .	128—133	..	4 17 9
75,000	,,	,,	5⅗	Do. C 3½ p.c. . .	—	..	—
80,075	,,	June 27	3	Do. 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Aug. 15	5⅝	West Ham 5 p.c. Ord. .	101—104	..	4 18 6
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	118—120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div."

PROPOSED ELECTRIC LIGHTING AT CARMARTHEN.

A long and lively discussion was indulged in by the members of the Carmarthen Town Council when the question of the advisability of sealing a contract with Messrs. J. B. Saunders and Co., relative to an electric lighting scheme came up for consideration.

The agreement was explained by the Town Clerk (Mr. R. M. Thomas), who said that certain alterations had been made in it. Originally there had been a heavy penalty provided if Messrs. Saunders did not carry out their undertaking within eighteen months of obtaining the Provisional Order. They objected to this; and the penalty clause was waived to a certain extent by the Council, and it was suggested that a penalty should only be recoverable in case the Contractors gave notice that they were going to proceed and did not proceed. As the contract stood, there was a definite undertaking that the scheme would be carried through. In the amendment, this was cut out by Messrs. Saunders altogether; and it was left open to them to go through with the scheme or not as they thought fit. The only security which the Council would have would be that Messrs. Saunders would have spent a certain amount of money in getting a Provisional Order, and in other preliminary expenses. The Council would then be in the position that for eighteen months they would have to wait to see whether Messrs. Saunders would go on with the work; and they would not be able to avail themselves of any other chance during that time. On the other hand, Messrs. Saunders would have been able to withdraw without any penalty. This did not seem to him (the Clerk) to be the state of things contemplated by the Council. As the contract now stood, the Contractors would have within eighteen months either to give notice of their intentions to proceed, or else to forfeit £100. If they gave notice and did not proceed, there was a much heavier penalty. There was now no distinct obligation on the part of Messrs. Saunders to carry out the contract, except that they were liable to forfeit £100, and any expenses which they would otherwise incur. Then there was a clause which he had inserted with regard to the failure of the light, and which gave the Council power to step in and take control of the works in case of any failure. His clause was that, in case of a failure for fourteen days, the Council could step in; and that in case the fault continued for six months, the Council could purchase the concern at its "scrap" value. He had inserted this clause having regard to the contingency of the Contractors going bankrupt or otherwise failing to carry out their obligations. The only material point in which the Contractors had altered this was that the Council could step in in case of a total failure; and that in the event of a purchase under such circumstances, the price to be paid would be that of a going concern. Some alterations had been made with regard to the power of assignment. Messrs. Saunders wished to have power to assign their rights and liabilities under the contract to anybody else. In that case, Messrs. Saunders would be free of all responsibility; and the Council would have nobody to look to except the assignees. The clause as now in the agreement gave Messrs. Saunders power to assign their liability for the maintenance of the light, though not the penalty for failing to instal it.

By the time the end of the discussion was reached, some of the members had become so confused that the recording of the votes proved a difficult matter. The agreement was, however, ordered to be sealed.

THE SMOKE PROBLEM

At the Sanitary Inspectors' Conference.

At the conference of the Sanitary Inspectors' Association which took place last week at Llandudno, two papers were read dealing with the question of smoke abatement.

The first of these was by Sir William B. Richmond, R.A.; and in the course of it, he remarked that coal smoke was merely waste of fuel. It was a destructive and disagreeable agent, and was as preventable as it was unnecessary. What was wanted to secure its prevention, was that public opinion—which was the governing force in all communities of the past, the present, and the future—should shake off inertia, and with one voice proclaim its determination to force the hands of the selfish or thoughtless, and oblige them to cease from abusing their prerogatives of wealth, to abstain from damaging other people's property, destroying beauty, making dirt, and obscuring the sun—the giver or disseminator of life. The absurdity of the defence of the nuisance put forward, that "smoke and commerce were inseparable," was shown by the fact that every puff of smoke from a chimney-shaft was waste; and it was therefore unbusinesslike to permit it. Those who did permit it were short-sighted as to their own interests, and inconsiderate towards others. But man did not live by bread alone. They were gifted in this country with great beauty of landscape—and especially so in regard to the very districts which had now become squalid and unhealthy owing to this smoke curse. No great change which involved the loss of intelligent hand labour was all for good; but granted that machinery was a necessity, those who employed it should be forced by public opinion, and through that by law, not to make it a nuisance, and to destroy by its fumes and smoke adjacent properties, trees, fruit gardens, churches, cathedrals, and what not. It would be said that a law which compelled the entire abolition of smoke would be unpopular. No doubt it would be to a rich minority, but it would be vastly popular to the majority; and it was a mere sophism to say that such a law would be in restraint of trade. Westminster Abbey was fast decaying from the effect upon its surface of coal smoke; and many of our cathedrals were in like plight. Yet they sat still—Parliament did, anyhow—and let this evil go on, until perhaps future generations would be done out of their just rights to the enjoyment of the great works of art given to the present generation to take care of and transmit. When the abominable demon of smoke was expelled, there would be gardens on the house

THE WORDS OF ONE BUT THE VOICE OF MANY.

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GENERAL MANAGER

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Show Rooms,
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Portsmouth 3rd August 19 07.

Messrs Bland & Co,

London.

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Yours faithfully,

J. D. Ashworth

General Manager.

Facsimile of letter received by Bland & Co., 63, Queen Victoria Street, London, and Manchester.

tops, trees in all the streets, and fountains of pure silver water bubbling up in the squares. There would be less squalor, less drink, more outdoor healthy life, greater sanitation, and, above all, a happier people. Science taught yearly more and more the importance of sunlight; and when the man in the street was aware of that, he would not suffer to live in an atmosphere not fit for a human being, or under conditions of dirt, against which his proud spirit should revolt.

Mr. W. Nicholson, of Sheffield, who contributed the second paper—dealing with the practical question of smoke prevention—estimated that there was in the atmosphere over these islands daily thousands of tons of coal in the form of vapour; and of the 150 million tons of coal consumed annually in this country, one-third might be saved if a sensible and scientific scheme were adopted in the burning of the fuel. Owing to the crusades of the Smoke Abatement Association founded in Sheffield, due to the advocacy of the late Sir W. C. Leng, that city, which was formerly so much afflicted with the smoke nuisance, had, in consequence of the adoption of drastic measures by the Corporation, so improved that last year it had 1437 hours of sunshine, or 368 more than Manchester, 367 more than Bradford, 265 more than Glasgow, 189 more than Leeds, 186 more than Birmingham, 158 more than Edinburgh, 53 hours more than York, and 53 more than Bettws-y-coed. He alluded to a number of mechanical stokers, underfed furnaces, and other apparatus intended to bring about perfect combustion, and added that the law against smoke pollution was already almost sufficient to produce the required relief from the nuisance, provided that it was properly enforced. He recommended, however, that the law, which now only prohibited black smoke, should be made to apply also to every kind of visible smoke emitted from chimneys, and that domestic fires should be included, inasmuch as the smoke from dwelling-houses was due to defects in combustion, which might be overcome by the provision of proper grates and by proper management of the fires.

A vote of thanks was accorded to the authors; the proposer expressing a desire to know whereabouts in Sheffield the sunshine record was taken. The President (Sir James Crichton-Browne) also remarked that the towns with which Sheffield had been compared would probably like to have a very accurate definition of what was considered sunshine in Sheffield. Mr. Nicholson, in reply, however, assured the meeting that the sunshine records at Sheffield were accurately taken.

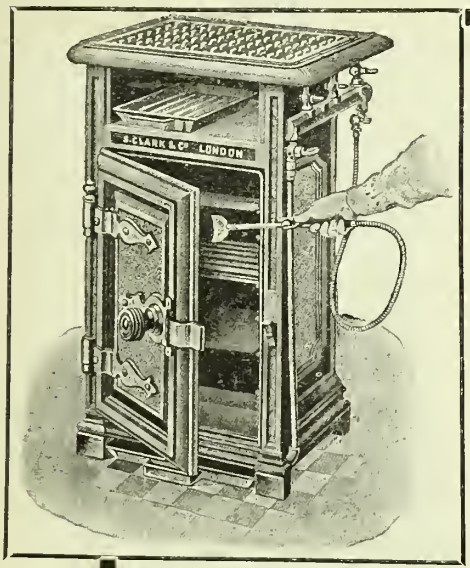
It has been pointed out, says the "Accountant," that the Prevention of Corruption Act, however excellent the intentions may have been, and undoubtedly were, with which it was passed, has had the unexpected effect of placing English firms at a considerable disadvantage in competition with foreign houses; for the latter, conducting their business from abroad, do not hesitate to avail themselves of methods which would, under the Act, be extremely risky on the part of English concerns. It would be interesting to know whether this is an oversight in the Act, or whether it was thought by the drafters that any rights of action which may exist against the recipients would effectually cover the point.

ALDERMAN GAINSFORD'S EXPERIENCES AT SHEFFIELD.

Alderman T. R. Gainsford, whose resignation of the chairmanship of the Sheffield Water Committee was recorded in our last issue, has contributed to the columns of the "Municipal Journal" a few notes of his experiences during the twenty years he occupied the position.

He states that his experience as Chairman began in 1887, just after the passing, by the House of Lords, of the Bill of the Corporation for the purchase of the water undertaking, and the rejection of the Bill of the Company for extraordinary powers, but before the former Bill went before the Second House. The Lords Committee, under the late Lord Derby, had declared that, though no default was proved against the Company, still, on grounds of public policy, the concern should be transferred to the Corporation, but that, under such circumstances, the terms of purchase must be not only fair, but liberal. Obviously, this declaration made the position very difficult for the Corporation; and the Company were strenuous in their use of it. His first determination, therefore, was not to risk a second contest in the House of Commons, but to settle the purchase by negotiation. This had to be done with a Company peculiarly unapproachable—who already had a parliamentary declaration in their favour for "liberal terms"—and it had to be settled in the very short interval between the final passing of the Bill by the House of Lords (for it was further opposed and debated in full session of that House) and the House of Commons Committee. However, he managed to do it; and the settlement, though purchasing property valued at about £2,100,000, was effected financially without any raising of cash (except about £50,000 for the trading debts and the bank overdraft), the whole capital of the Company being taken over in exchange for Corporation annuities. The terms of settlement, though much doubted at the time, and while extremely good for the shareholders of the Company, had also proved very successful for the Corporation. The House of Lords' decision in the Sheffield case fixed at least one great principle in municipal trading. Parliament had never since refused the demand of any great population to own and control its own water supply. Whatever might be said about other forms of municipal trading, at least the supply of water to a great population or trading community was now universally admitted to be rightly placed in the hands of the public authority, and its purity, fulness, and cheapness to be detached from any possible influence of either private profit or interest.

The Corporation started at Sheffield, as owners of the water undertaking, with a capital debt of about £2,100,000, and with the duty to supply water to more than 400,000 people, and to immense trading industries, with these principles: That the supply of water by the public authority ought to be conducted on ample and generous lines; that their duty was to serve the public; to be open, candid, and liberal; to acquire and to keep the confidence of the people; and to meet their wishes, even if sometimes unreasonable—bearing in mind that resistance to a public demand often only increased it. He thought they had



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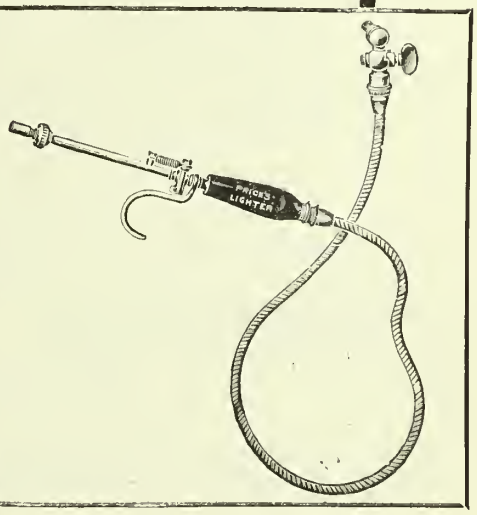

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Dealing with the Corporation's parliamentary contests regarding the Little Don and Derwent areas, Alderman Gainsford emphasizes the need for preserving and utilizing to the best advantage the water-gathering areas of this country for the supply of the big populations; and he concludes by advocating the creation of a Government Department for the audit of all municipal trading accounts, which should be reasonably uniform in character.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On another page will be found a report of the interesting proceedings which took place at Stirling last Tuesday. The company which assembled to witness the inauguration of the new plant was a small one, but contained quite a number of the gentlemen whom we are always pleased to meet on such occasions. A striking feature of the works at Stirling is the extraordinary change which has been made upon them since Mr. J. D. Smith was appointed Manager about ten years ago. He took charge of the works just as the day of commercial competition was dawning; and being fully qualified for entering upon the new order of things, and full of that courage, not of boastfulness, but of restfulness, which is the true courage, he faced the situation without hesitation. We have had, in Scotland, fairly numerous instances in which new gas-works have been erected upon new sites, greatly to the advantage of the communities served as well as of the gas undertakings, but a quiet transformation, such as we have had in Stirling, the utilization of the old site for the erection of new works of much greater capacity, is an experience not by any means unknown, but so rare that it commands attention and must be accorded credit—all the more so when it is carried out, as has been the case here, in a manner which secures both practical and financial success. The works at Stirling are so hemmed in, by the railway on one side and the town upon the two other sides of the triangular space they occupy, that extension of the area was impossible; and I am afraid that any attempt to transfer the works to a new site would have met with strenuous opposition. Mr. Smith has avoided this by bringing into play his engineering abilities; and he has, by the exercise of these, very largely increased the producing capacity of the works, and at the same time improved and cheapened the methods of working. Tuesday's proceedings were of an exceedingly pleasant nature, and the recollection of these, together with the contemplation of the possibilities opened up by the bringing into full operation of such fine works as they now possess, gives good ground for the expectation that a period of greater prosperity than they have yet experienced is in store for the Stirling Gaslight Company.

The Valuation Appeal Courts have concluded their labours for the year. These have been so unusual that note has been taken of them in the "Legal Intelligence" columns of this and last week's issues of the "JOURNAL." The interest has arisen through the action of Mr. P. Sulley, a new and energetic Assessor in the southern counties of Scotland, who has discovered circumstances existing which he has persuaded himself into believing have constituted an injustice to the local authorities. He considers that gas undertakings have been under assessed, with the consequent loss of rates; and he has set himself to remedy matters by applying his interpretations of statutes and decisions, which form the somewhat unstable medium from which assessors derive their guidance in the fixing of the valuations of industrial concerns. It will be observed that in the appeals dealt with, the Assessors have relied almost entirely upon decisions in the courts, and have given little indication that their authority is in Act of Parliament. In the varying decisions of the courts of law is to be found opportunity, if the assessor be so disposed, for the settlement of a particular case, either one way or another. Thus we find the same gentleman, who maintained at Jedburgh one day that the Melrose Gas Company should be assessed upon the average returns of five years, by which the valuation was greatly raised, two days later, at Duns, refusing to assess the Eyemouth Gas Company upon an average of years; and, pleading before different benches, he was successful in both instances, having authority behind him for taking whichever course best suited his purpose. There was another case, not connected with the gas industry, which came before one of the Valuation Committees in Lanarkshire, in which a new principle, only possible when matters are in a mixed-up condition, was involved. In this case, a large industrial undertaking had, in order to enable them to meet the more severe competition which now besets them, improved their works so that the Company are now able to produce the articles they manufacture at a cheaper rate. But as soon as they had effected this improvement, the Assessor swooped down upon them, and, upon the plea that their works were now in such a condition that a tenant would give a much higher rent for them, he raised the valuation to a degree which would have very largely counteracted any benefit the Company might have expected to derive from their improvements. From whatever point the duties of assessors may be viewed, it surely cannot be said that the Legislature ever contemplated that they were to operate, even in the slightest degree, in the direction of restraining trade. Yet that is what would have happened in the Lanarkshire case, had not the Committee

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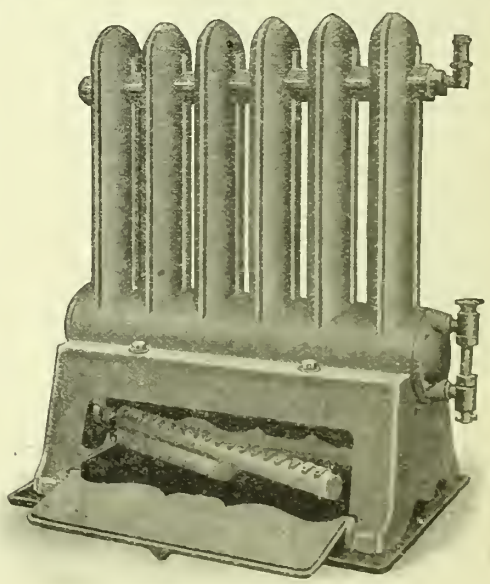

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seen the hardship of the application of hard and fast rules by the assessor, and granted a modification. A reform of the laws regulating valuation has long been wished for. The experiences this year in Scotland, to which attention has been called in the "JOURNAL," give emphasis to that wish, making it more than ever apparent that there is great need for the establishment of a guiding principle in matters of valuation, a principle which would be simple in its working and equitable in its application—two qualities which it cannot be said distinguish valuation proceedings under present conditions.

In the Falkirk Town Council on Monday, the Gas Committee recommended that the price of gas to all consumers be increased by 1d. per 1000 cubic feet from the October quarter—being for lighting 2s. 10d., cookers with ordinary meters 2s. 7d., prepayment meters 2s. 11d., power 2s. 5d., and prepayment meters for lighting 3s. 2d. Mr. Wilkie, the Convener of the Committee, in moving approval of the minutes, said they would see they had the estimates before them for the current year, and after careful consideration they accepted them as presented by the Manager (Mr. W. Wilson). Arising out of the estimates was the consideration of the price of gas for the ensuing year; and they found that it was necessary that they should make some advance. When they took into consideration the large increase of the price of coal, averaging from 2s. to 3s. per ton, they saw that 1d. per 1000 feet did not fully cover them. But they estimated that there would be a considerable saving in connection with the manufacture of gas, and they had also to take into consideration that there had been a corresponding increase in the price of coke. Referring to the annual accounts, he said that he was sorry these were not what they ought to be. As they looked over these accounts, they felt that the least said about them the better. On the coal account, though they had had an increase of close on £3000 on the estimates, when they took into consideration that the average gas manufactured turned out about 8000 cubic feet per ton, they realized that there had been a considerable loss. They must own there had been something very lax in the management of the undertaking; but, of course, there had been circumstances over which they had no control. The results of the past year had been so disastrous that they had only been able to place to the reserve fund £500; and they had had to eat into the balance carried forward from last year by nearly £1600. There was about £1500 they could hardly account for during the past year. He thought that if the estimates had been properly considered they would never have been able to lower the price of gas last year as they did (1d. per 1000 cubic feet). The greatest discrepancies were in wages and coal. The estimates for the coming year, he thought, were very carefully considered. The present Manager had kept within bounds with the probable income. He worked out his average at close on 7500 cubic feet per ton. He hoped that it would come up to very near 9000 feet. Bailie Bogle, in seconding, said Mr. Wilkie might have made his statement more clear to those who do not know the various circumstances that led up to the estimates being so very much under what they ought to have been. All of them believed that the railway communication would do away with all cartage; but they were well aware that there was a great deal of delay in getting the railway communication. This caused a very heavy cartage bill, which, of course, was not estimated for. Then many breakdowns took place, which necessitated the works being carried on by hand; and this caused a great increase in wages. There was, too, the increase of the coal bill. During the whole of the financial year, they were very much handicapped for holder room for gas; and often during November they just made sufficient gas for each day. The coal they had was quite incapable of giving gas sufficient for the town. He thought when they took all this into account they should be very thankful that they had got over as well as they had. With regard to leakage, he could explain this as due to the greater pressure of gas now; and they all knew that throughout the whole of their district the pipes were in a very bad condition. Until all their main pipes were renewed, it was almost impossible for the leakage to fall below what it was. The recommendation of the Committee was agreed to.

The Elgin gasholder question, of which so much has been heard of late, is to run its course before the Sheriff. It will be remembered that the latest phase was that the Town Council resolved, with a view to satisfying the objectors to its erection, to excavate for the tank, and so reduce the height of the holder by 15 feet. This resolution was communicated to the Agent for the objectors; and the Town Council held a special meeting on Wednesday to consider the reply which had been received from the Agent. The Deputy Town Clerk read the letter which had been received from the Agent, which was to the effect that he had consulted his clients, and was instructed to state that, while lowering the gasholder as suggested, if practicable (which his clients had reason to doubt), would mitigate, to a very limited extent, the objections to its erection where proposed, it by no means removed them; and the objectors still trusted that the Council would see their way to adopt one of the alternative suggestions made at the recent conference between the Council and the objectors. Provost Christie said he was sorry that the Council's concession had not proved acceptable, but he did not think there was any other alternative they could adopt. Bailie Gordon, the Convener of the Gas Committee, said he regretted the decision of the objectors, because he thought the Council were very liberal in making the concession they had made. He moved that the Town Clerk be instructed to present a petition to the Sheriff, intimating that a settlement had not been come to, and asking him to dispose of the petition of the Council for an order dispensing with consents. Mr. Ritchie seconded, and after discussion the motion was unanimously agreed to.

A considerable time ago it was intimated that application had been made to the Corporation of Aberdeen by the Local Authority of the somewhat distant suburb of Dyce for a gas supply. The Town Council, after inquiry, agreed to give the supply; and at a meeting on Monday they gave authority for the extension of the gas-main to Dyce, at an estimated cost of £1090.

At the Dunbar Town Council last week, it was explained that the Burgh Chamberlain had had a conference with the Assessor regarding the valuation of the gas-works, which was considered too high; and that an arrangement had been arrived at whereby the valuation had been reduced from £721 to £591.

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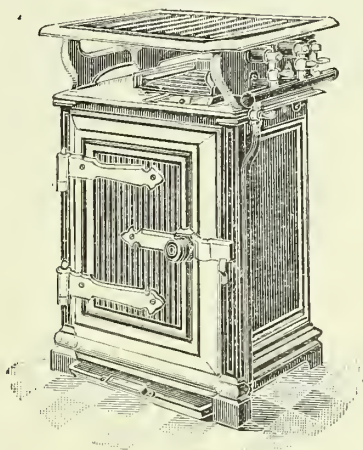

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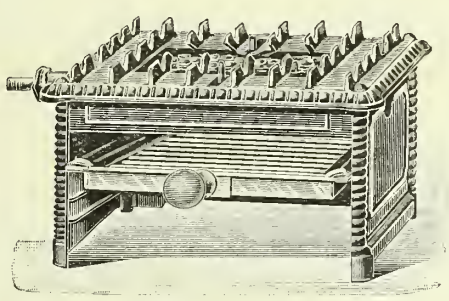

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 21.

Sulphate of Ammonia.

The market remains without any special feature upon which to comment. There is no accumulation of stock at any point, and current production is being readily absorbed, but demand is not sufficient to bring about an advance in prices. The demand is, in fact, still mainly for covering September contracts, and direct orders remain scarce. Quotations at the close are consequently £11 15s. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There is not much doing in the forward position; buyers being indifferent in regard to October-December delivery, and unwilling to pay the premium demanded by makers for delivery over the spring months. Any orders booked are, therefore, being taken speculatively at about the level of spot prices.

Nitrate of Soda.

The market is quiet but steady, and spot prices are 11s. 1½d. and 11s. 4½d. per cwt. for 95 per cent. and refined qualities respectively.

LONDON, *Sept.* 23.

Tar Products.

There has been little change in the market for tar products during the past week. Pitch is quiet and difficult of sale on the Continent, where consumers appear to be well supplied for delivery to the end of the present year, and also report having had offers at very low figures for all over 1908. Business has been done on the east coast at 25s. to to 25s. 6d. for delivery to the end of the year; while on the west coast, 25s. has been accepted for prompt delivery. Most of the London manufacturers are out of the market; but it would be possible to buy some quantity at 26s. for prompt delivery. Creosote is steady without any alteration in prices. The Midland manufacturers are willing to sell at 3d. per gallon to the end of 1908, and will probably be able to do business at this figure before very long, as oil in this district is decidedly scarce. In the North, sales are reported at 2¾d. to 3d. per gallon, while in London 2⅞d. is about the value for prompt delivery; but manufacturers will not sell very far forward. Benzol, 90 per cent., is quiet; but prices are practically unchanged. Benzol, 50 90 per cent., has been sold at prices varying from 8½d. to 9d. There is no demand whatever for toluol. Solvent naphtha is quiet. In the North, manufacturers would accept 1s. per gallon; while in London, country makes have been offered at 1s. 1d. London manufacturers would probably accept 1s. 2d. Heavy naphtha is decidedly quiet. Carbolic acid is steady. Business has been done at 1s. 7d. per gallon at manufacturers' works, for delivery over the first six months of 1908.

The average values during the week were: Tar, 15s. to 19s. 6d., *ex* works. Pitch, London, 26s. to 27s.; east coast, 25s. to 25s. 6d.; west coast, 24s. 9d. to 25s. 9d. Benzol, 90 per cent., 8d. to 8½d., casks included; 50-90 per cent., 8½d. to 9d., casks included. Toluol, 10d. to 10½d., casks included. Crude naphtha, 4d. to 4¼d. naked; solvent naphtha, 1s. to 1s. 2d., casks included; heavy naphtha, 1s. to 1s. 1d., casks included. Creosote, London, 2⅞d. to 3d., naked; North, 2¾d. to 2⅞d., naked. Heavy oils, 3d. to 3¼d., naked. Carbolic acid, 60 per cent., 1s. 8d. to 1s. 8½d., casks included. Naphthalene, £6 10s. to £8 10s., packages included; salts, 37s. 6d. to 42s. 6d., packages included. Anthracene, "A" quality, 1½d. to 1¾d., casks included.

Sulphate of Ammonia.

This article is steady, and there appears to be a rather firmer tone in the market during the last three or four days. The principal London Gas Companies still quote £12 1s. 3d. for prompt delivery, and £12 3s. 9d. for forward; while ordinary London makes are quoted at £11 12s. 6d. to £11 15s., on Beckton terms. In Hull, business has been done at £11 16s. 3d.; while in Liverpool, £11 17s. 6d. to £11 18s. 9d. may be taken as about the ruling value. In Leith, £12 is reported to have been refused for prompt delivery, and £12 2s. 6d. may be regarded as the ruling figure for prompt, and £12 5s. for forward delivery.

Barnstaple Water-Works.—Mr. C. E. R. Chanter, the Chairman of the Barnstaple Water Company, formally inaugurated yesterday week the new filter-bed which has been constructed in connection with the town supply. This addition to the undertaking has cost £1175. The bed is 60 feet in length by 40 feet wide, and has a filtering capacity of 150,000 to 200,000 gallons per day. The ceremony of turning the water into the bed took place in the presence of the Directors and others interested. It was pointed out that since the formation of the Company Barnstaple had had a constant and abundant water supply, which was unaffected by the most severe drought. The Company was founded in 1857, and took over an undertaking whose history dated back to 1699. The water is brought from Exmoor through several miles of leat and pipes; and the supply is sufficient to furnish 60 gallons per head per day to a population of 15,000. There is a low-level service reservoir with a capacity of 400,000 gallons; and from this the water is pumped 130 feet to a high-level service reservoir containing 300,000 gallons.

Crewkerne Water Purchase Question.—The Crewkerne Urban District Council, as the result of a long discussion at a special meeting, have passed the following resolution regarding the proposed acquisition of the local water-works, which has lately occupied much of their attention: "That, notwithstanding the report and valuation of the Water Company's undertaking by the Council's expert (Mr. Brough Taylor), at £14,335, this Council, being desirous of making the purchase, and, if possible, of avoiding the introduction of an opposing water undertaking, which must be detrimental to the shareholders of the existing Company, shall again offer £14,500 for the acquisition of the Company's works, property, and assets of all descriptions (enumerated in previous correspondence with the Water Company), with a request that the offer be accepted or declined within seven days, and that, in the event of the offer of £14,500 being not accepted, by the expiration of such seven days, the Council instruct a competent engineer to make a survey in and around the town of Crewkerne, with the view of ascertaining what supply or supplies of water can be recommended to be introduced by the Council, and to make his report thereon."

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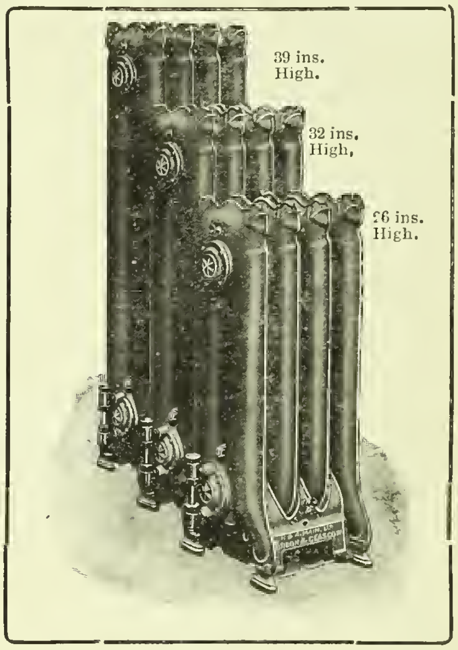

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COAL TRADE REPORTS.

Lancashire Coal Trade.

The coal trade of Lancashire was never better than it is at present; and the only fear on the part of coal proprietors is that the existing railway troubles may lead to a dislocation of carriage in the near future, in which case the coal trade would he very seriously hampered. It is reported that the Midland Railway Company have accepted the terms of the South Yorkshire coalowners for the supply of locomotive fuel at 12s. per ton, and of Nottingham and Derhyshire colliery proprietors at 11s. Last year the price was 8s. 6d. per ton for South Yorkshire coal. It is understood that the Great Northern and the Great Central Railway Companies are about to follow the example of the Midland. The struggle for coal at last year's prices has been going on since June; and the colliery proprietors have triumphed. They had ohtained a position which made them independent of railway contracts. It is now certain that coal from the South Yorkshire fields for other purposes will be dearer; and, if so, Lancashire will not hesitate to follow. The demand for steam coal could not he stronger than it is. House qualities have declined in demand for the present; but it is only temporary. Little fresh gas coal and cannel are going out just now. The contracts for the year were signed several months ago, and deliveries are in accordance with requirements. There is no alteration in the average prices at the pits given last week.

Northern Coal Trade.

The coal trade is rather more active; but the milder weather has limited the consumption of some classes of fuel. In the steam coal trade, there is a steady production at the collieries, and, with steamers coming more freely forward to the loading ports, shipments are heavy, though there is still a little ease in the prices. Best Northumhrian steams are quoted from 16s. per ton f.o.b., though there are some a little lower. Second-class steams are 15s. to 15s. 3d., and steam smalls from 10s. to ahout 10s. 6d. Forward prices are rather uncertain, as buyers anticipate reductions such as are usual in the northern steam coal trade late in autumn, while collieries seem to be firm in their quotations. In the gas-coal trade, hest kinds are very firm in price; hut second-classes are perhaps a little easier. Durham gas coals vary in price from ahout 14s. to 15s. 9d. per ton f.o.h., according to the quality. The demand seems to he good for this season, and to show the tendency to increase that is usual at the time of lengthening nights. There is little to report as to contracts, though there are negotiations in progress for sales for export over next season. In such cases, the general quotations are helow those current for the winter supply. In coke, prices are firm; and the gas coke trade is hrisk, despite the increased supply. For export, 20s. per ton f.o.b. is the current quotation. Prices are higher with the inland gas producers, where values do not move so readily.

Scotch Coal Trade.

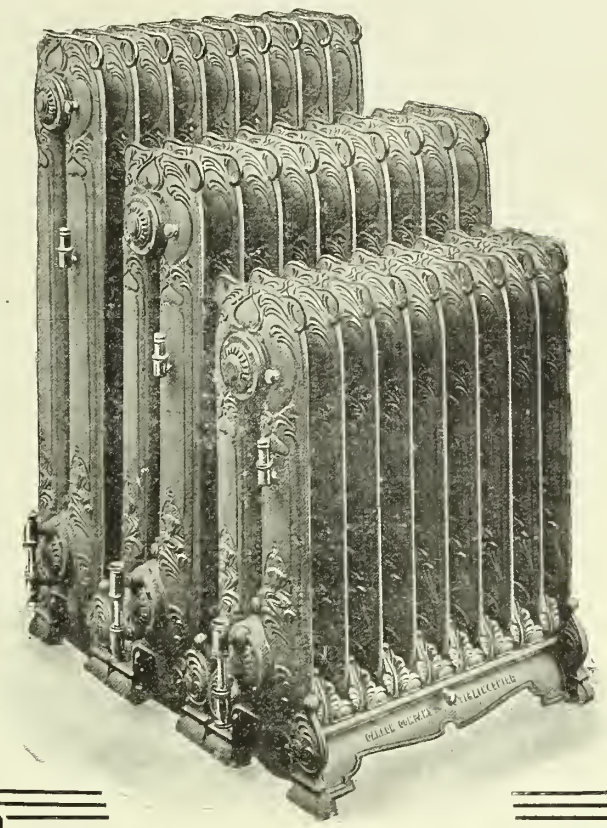
Trade proceeds upon the same lines, so far as supply and demand at home are concerned, though there are disturbing elements in the threatened strike of railway servants, and in the trouhle in the shiphuilding trade. On account of both of these circumstances, manufacturers are disposed to stock as much as they can, even at the high prices ruling. The settlement of hoth of these difficulties with labour, if accomplished, would go far to give ease to the coal market. The prices quoted are: Ell 14s. 6d. to 16s. 6d. per ton f.o.b. Glasgow, splint 15s. to 15s. 6d., and steam 14s. to 14s. 3d. The shipments for the week amounted to 307,137 tons—a decrease of 17,186 tons upon the previous week, but an increase of 8296 tons upon the corresponding week of last year. For the year to date, the total shipments have been 10,355,670 tons—an increase of 661,658 tons upon the same period of 1906.

Scott-Snell Vacuum Gas-Compressor.—A Joint-Stock Company has recently heen registered (with a capital of £5000 in £1 shares, 2500 deferred) to acquire certain rights under a provisional patent granted to C. H. Stuart and C. Scott-Snell for the United Kingdom, in respect of improvements in gas lighting. There is to he no initial public issue. The first directors are to be: C. Scott-Snell, C. H. Stuart, H. C. Booth, and F. Clench.

Gas-Works for Liphook.—An intimation has been given to the Rural Council at Petersfield, Hants, hy the Solicitors to the promoter, of an intended application to the Board of Trade for a Provisional Order authorizing the construction of the necessary works with a view of supplying gas for public and private use in the Woolmer district, including Liphcok, Liss, and Greatham. A suitable site has been obtained at Liphook.

Testing Consumers' Fittings at Liverpool.—At the last meeting of the Lighting Suh-Committee of the Liverpool Tramways Committee, the Superintendent of Street Lighting (Mr. A. G. Smith) reported that he had dealt with 31 applications for the testing of consumers' gas pipes and fittings since the previous meeting. Of these, 28 were found to he unsound, causing the gas to escape at the aggregate rate of 20¼ cubic feet per hour, representing an annual loss, with gas at 2s. 6d. per 1000 cubic feet, of £22 0s. 8d.

Price of Gas at Wisbech.—Some discussion has taken place at Wishech with regard to the price which the Corporation are called upon to pay for gas; and a deputation from the Lighting Committee has waited on the Wishech Lighting Company. When the matter came hefore the Town Council, the Mayor (Mr. J. Yates) said the Company were supplying them at 2s. 11d. per 1000 cubic feet, as compared with 3s. charged to private consumers. The Corporation were very large users of gas—in fact, of the total receipts of the Company one-sixth came from the Corporation; so he thought they ought to have some consideration from the Directors. The Company had not reduced the charge owing to the increased price of coal. After discussion, the contract with the Company for street lighting for a year at £3 6s. per ordinary lamp and £3 10s. per incandescent lamp, less 5 per cent. discount, was agreed to.



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Swansea Water-Works Assessment.—It is reported that the Brecon Assessment Committee have made a re-arrangement of the valuation of the Cray reservoir belonging to the Swansea Corporation; one assessment, instead of two, having been adopted, and the sum of £16,000 previously decided upon being slightly reduced. The Corporation will, however, still go on with their appeal; the reduction not being considered adequate.

Main-Laying Operations at Chagford.—At a meeting of the Okehampton Rural District Council on Saturday, a letter was read from the Devonshire Gas Association asking permission to open the streets at Chagford in order to relay the whole of the mains and make a thorough job, after which they hoped that the roads would not require to be opened again for many years. A letter was read from the Surveyor saying there was no objection to the proposal, subject to certain restrictions. These included a time-limit for the work, that there should be as little interruption of the traffic as possible, that notice be given by the contractor when the work commenced, and that the roads should be reinstated in their former condition. The Chairman said the Association should be called upon to sign these conditions in writing. The restrictions were very proper. Mr. Smith (Councillor for Chagford) remarked that it was proposed to dig up the whole town to relay the mains. It would be a great disturbance to the residents; but he supposed it was better than to go on tinkering. The application was granted, subject to signed conditions by the Association; and the Surveyor was directed to report at once to the Council any failure to comply with the stipulations.

At Hurstpierpoint, the Gas Company have agreed to supply gas at 4s. 6d. per 1000 cubic feet, and to clean, light, and extinguish the 63 public lamps for 18s. per week.

Gas is proposed to be established for public and private use at Lyndhurst, in the New Forest. It is expected, if no hitch occurs in the arrangements, that lighting will take place next February.

The Local Government Board have given sanction to the District Council at Shanklin to raise a loan for the preliminary works at Chillerton, in connection with the auxiliary water supply. The scheme will, it is expected, cost about £15,000.

The Rural District Council at Petersfield (Hants) have agreed to apply for permission to borrow £680 for the sites necessary to supply the parish of Liss with water; and the offer of the Private Works Loan Board to advance £6220, for 29 years, at 3½ per cent., for the whole scheme, was accepted.

"Water and Its Work" was the title of a University Extension Lecture delivered at Exeter last Thursday by Professor Vivian B. Lewes. Dr. Davy, the President of the British Medical Association, occupied the chair; and the lecture (which was illustrated by experiments) was enjoyed by a large audience.

The Torbay Paint Company (Messrs. Stevens and Co.) intimate that, in consequence of the death of their late esteemed partner, Mr. Herbert Firth Burrows, they have (as from July 1 last) admitted into partnership his eldest son, Mr. Spencer Freeman Burrows, who has for some years been associated with the business.

According to a telegram through Laffan's Agency, the municipal authorities of Berlin have entered on a three years' agreement with a company who propose to affix small metal advertising plates to all the lamp-posts and electric light standards in the capital. The rent charged is £1 per post. The revenue from this source is estimated to reach £10,000 per annum.

Messrs. Joseph Taylor and Co., of Bolton, have received orders from the Lincoln Corporation Gas Department and Messrs. Ingham's Thornhill Colliery, Dewsbury, for their latest makes of solid plate-lead saturators, designed for either fishing or steam ejecting, and fixed on pitch pine cradles. A further order has been placed with the firm by the Canterbury Gas Company.

The Manchester Water Committee have decided to apply for power, in the next Bill promoted by the Corporation, to carry out a scheme for dealing with flood waters in connection with the Torside and Woodhead reservoirs. This is regarded as necessary to secure the safety of the existing works. The Committee have had submitted to them a report on the subject by Mr. G. H. Hill.

In noticing a statement published in the American papers, to the effect that an experiment in profit-sharing among the operatives of the Fall River cotton mills has failed, the "Daily Express" says: "In this country there are something like a hundred firms which have profit-sharing agreements with their workers; and in many of them the scheme works smoothly. In the South Metropolitan Gas Company, for instance, the workers have submitted without demur to the reduction in their bonuses which the recent increase in the price of gas has entailed. We should like to see these experiments tried on a wider scale. They would educate the workmen to a recognition of the fact that the fluctuating lot of capital is not so easy and comfortable as the great mass of workers suppose."

Some days ago, there was a large gathering at the Victoria Hall, Exeter, to hear an organ recital and to see the place newly lighted by sixteen of the latest pattern Welsbach self-intensifying incandescent gas-lamps, of at least 500-candle power each. Those for the ground floor and the stage are suspended by steel-wire rope; and the gas is supplied through flexible tubes. They can thus be raised or lowered, or moved to any desired position. Two taps only, at the side wall, control the ten central lamps; and the whole can be turned up and down instantaneously. The stage lamps are also controlled by one tap, and can be operated similarly. The total light of the whole installation is 8000 candles; and the result is a very great improvement, every part of the hall being brilliantly and evenly lighted. This increased light has been obtained with a reduction in the consumption of gas; the quantity now required to light the hall being less than one-half of that used by the old system. The present 8000-candle light will, it is calculated, cost just over 1s. per hour.

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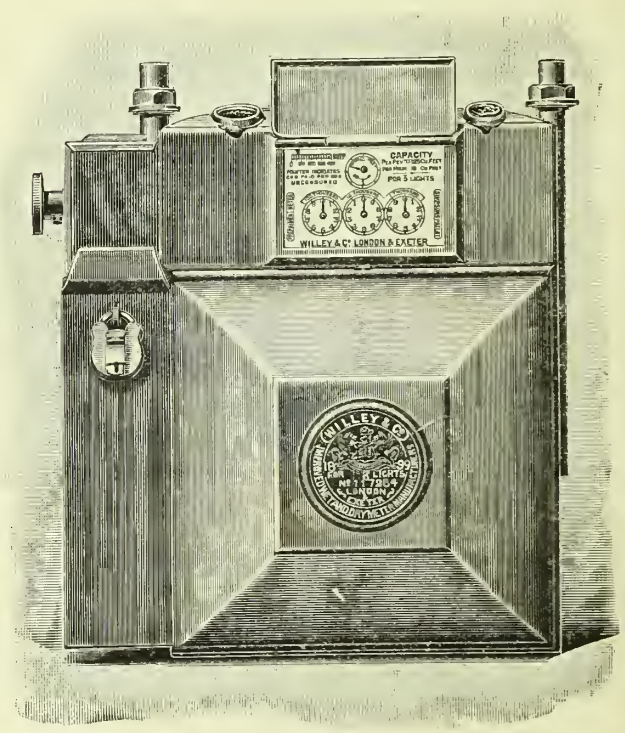

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No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

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Situations Vacant.

MANAGER. Oswaldtwistle Urban District Council. Applications by Oct. 1.
CHEMIST (RESEARCH). Leeds University. Applications by Oct. 3.
DRAUGHTSMAN. No. 4839.
GENERAL FOREMAN. Barking Gas-Works.
STOKER. Ystalyfera Gas-Works.

Gas Literature Wanted.

L. P. LOWE, 1214, Polk Street, San Francisco.

Situations Wanted.

ASSISTANT OR MANAGER. Watts, R. H.
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Candidates must possess Experience in the Management of Gas-Works, the Laying of Mains, and the General Work of a Gas Department. The person appointed will be required to devote the whole of his time to the duties; and the appointment will be subject to determination by Three Calender Months' Notice on either side.
The commencing Salary will be £120 per Annum, with House, Coal, Gas, and Water free.
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Canvassing in any form will disqualify.
B. T. Westwell,
Solicitor, Clerk to the Council.
Town Hall, Oswaldtwistle,
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WANTED, immediately, a Gas Stoker in Small Works for Night Duty. Wages 28s. per week.
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Applicants to state Age, Experience, and send *copies* of Two Testimonials to No. 4839, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

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Applications will be received up to Oct. 3, by the Registrar, who will also supply further Information.

WANTED, a Second-Hand Air-Tube CONDENSER for 10,000 to 15,000 cubic metres per day, with about 300 mm. Inlet Pipe.
Forward Plan and Price to the Engineer-Director, Usine à Gaz, Huy, Belgium.

TO Gas Managers, &c. Wanted, Old Condemned GAS-METERS, from 1-light to 1000-light, for destruction to re-claim Metals. Write for Prices, Stating Quantities and Sizes. Scrap Metals, Drosses, Metal Shop Sweepings, &c, also bought.
J Wilson, Pleasant Grove, York Road, King's Cross, London, N.

STATION METER, GOVERNOR, AND PURIFIERS.

WANTED, a Second-Hand Station METER, capacity about 15,000 cubic feet per hour, Second-Hand STATION GOVERNOR with 12-inch Connections, also Four PURIFIERS, 14 ft. by 14 ft. or 16 ft by 16 ft. Must be in good order.
Prices and Particulars of any of the above plant to No. 4838, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FOR SALE—Four Cast-Iron Purifiers, One CENTRE VALVE (Newton Chambers), One Bryan Donkin's EXHAUSTER PLANT, One Small GAS-ENGINE.
Apply Waterside Mills, Hadfield.

GAS BOOKS WANTED.

MY Library of Gas Books, and Subjects akin thereto, and which I believe was the most complete in existence, was destroyed in the April 18, 1906, San Francisco disaster. In RE-ESTABLISHING this Library—which will find an ultimate home with a Gas Association or Educational Institution—I am desirous of securing all available Gas Literature printed in the English language, including Technical Works, Reports, Pamphlets, &c., and will PURCHASE such as I do not yet possess. Those having such works will accommodate me by sending a description thereof, stating Condition of Volume and net Price desired, Carriage included.
L. P. Lowe.
1214, Polk Street,
San Francisco, Cal., U.S.A.

ROCHESTER, CHATHAM, AND GILLINGHAM GAS COMPANY.

RETORTS, &c.

THE Directors invite Tenders for the Supply of FIRE-CLAY RETORTS, FIRE BRICKS, and CLAY.
Specification and Form of Tender may be obtained from the undersigned, to whom Tenders, endorsed "Retorts, &c.," must be delivered on or before Noon of Monday, Sept. 30, 1907.
J. M. Veevers,
Engineer and General Manager.
Gas Offices, Rochester,
Sept. 19, 1907.

COUNTY BOROUGH OF CROYDON.
Beddington Sewage Works.

CLINKER FILLING FOR FILTER-BEDS.

NOTICE is Hereby Given, that the Council are prepared to receive TENDERS for the Supply and Delivery of about 10,000 Tons of CLINKER FILLING for the Continuous Filter-Beds at the new works, Beddington Sewage Farm.
Specification, Conditions, and Form of Tender may be obtained at the Office of the Borough Engineer, Town Hall, Croydon, upon payment of a deposit of One Guinea, which will be returned upon receipt of a *bonâ-fide* Tender.
Tenders on the prescribed Form to be sent to me by Eleven o'clock in the forenoon on Friday, the 4th day of October, 1907, endorsed "Tender for Clinker Filling, Beddington Sewage Works."
Tenders will only be received subject to the terms of the Specification, General and Special Conditions, and to the draft Contract deposited at my Office, which may be inspected during Office hours.
The Council will not be bound to accept the lowest or any Tender.
F. C. Lloyd,
Town Clerk.
Town Hall, Croydon,
Sept. 17, 1907.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing such Capital, and also for including in these Periodical Sales Gas and Water Stocks and Shares belonging to Private Owners, can be obtained on application to Mr. Alfred Richards' Offices, 18, Finsbury Circus, E.C.

Ninth Sale, Water Order, 1902.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

IMPORTANT SALE OF NEW ISSUE OF SHARES IN THIS OLD-ESTABLISHED AND GOOD DIVIDEND PAYING COMPANY.

MESSRS. PENNEY & CLARK beg to announce that they are favoured with Instructions from the Directors of the above-named Company to SELL BY PUBLIC AUCTION, at their Auction Mart, King's Road, Southsea, on Tuesday, Oct. 8, 1907, at Seven o'clock in the Evening—in convenient Lots—The Ninth portion of the New Issue authorized under "The Borough of Portsmouth Water Order, 1902," consisting of
2000 SHARES OF £5 EACH
(fully paid), forming part of the New Ordinary Capital authorized under such Order.
The Auctioneers desire to call the special attention of Capitalists, Investors, and others to this very favourable opportunity of securing Shares in such a thoroughly sound local Company.
The Shares will be sold Free of any Charges, Fees, or Expenses whatever to the purchaser.
Full Particulars and Conditions of Sale may be obtained, with any further Information, from the Secretary of the Company, J. L. Wilkinson, Esq., F.C.I.S., at the Company's Offices, Commercial Road, Portsmouth; or of the Auctioneers, at their Auction Mart and Estate Agency Offices, King's Road, Southsea.
National Telephone No. 138.
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PAUL N. HASLUCK,

HONOURS MEDALLIST IN TECHNOLOGY.
EDITOR OF "WORK" AND "BUILDING WORLD."
AUTHOR OF "HANDYBOOKS FOR HANDICRAFTS," &c., &c.

WALTER KING, 11, Bolt Court, Fleet Street, E.C.

NOTICE.

To SECRETARIES and ACCOUNTANTS of GAS UNDERTAKINGS.

The end of the year is fast approaching; and now is the time to consider whether your system of accounts can be improved by **introducing labour-saving methods.** The Second Edition of

"GAS COMPANIES' BOOK-KEEPING"

(By J. H. BREARLEY, Longwood, and B. TAYLOR, F.I.P.S. Honors, Cleethorpes)

Contains many such methods, particularly as regards the accounts connected with Collection, Slot Installations, Fittings, &c.

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of a Gas Undertaking will find all the various books of account lucidly and completely explained.

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